Problems on Matrix Diagonalization

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Abstract

This document contains 150 different sets of matrices. Each set has five 3×3 matrices, with one matrix each of the following type:

1. All three eigenvalues are different;
2. Two eigenvalues are same and there are two linearly independent eigenvectors for this eigenvalue;
3. Two eigenvalues are equal and there is only one linearly independent eigenvector for this eigenvalue;
4. All the three eigenvalues are equal, and the matrix has in all two linearly independent eigenvectors;
5. All the three eigenvalues are equal, but the matrix has only one linearly independent eigenvector;
6. Answers on A4 size paper only. Attach the question paper with your answer sheets.

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences

Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor

email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -7 & -7 & 1 \\ 5 & 5 & -1 \\ -3 & -3 & 1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -3 & 4 & 4 \\ 0 & -3 & 0 \\ 0 & 2 & -1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -2 & -6 & 3 \\ 4 & 0 & 5 \\ 2 & 4 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 2 & 2 \\ -1 & -4 & -1 \\ -1 & -1 & -4 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -1 & 1 & 2 \\ 2 & -2 & 5 \\ -2 & -1 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId:I}}$

Indian Institute of Technology, Bhubaneswar

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M.Sc. Ist Semester 2015-16

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- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -7 & -7 & 6 \\ 8 & 8 & -6 \\ -5 & -5 & 6 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 0 & 0 & 3 \\ -2 & -2 & -3 \\ -2 & 0 & -5 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -4 & -8 & -7 \\ 1 & -3 & 1 \\ 3 & 7 & 6 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & -3 & 6 \\ -1 & -1 & -2 \\ -2 & 2 & -6 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 0 & 2 & 4 \\ -1 & 0 & 1 \\ -2 & -2 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: II}}$

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Assignment -I $\boxed{\text{Mathematical Physics}}$ MM: 20

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -7 & -6 & -9 \\ 4 & 5 & 4 \\ 6 & 4 & 8 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -7 & 5 & -5 \\ -5 & 3 & -5 \\ 5 & -5 & 3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -4 & 2 & -2 \\ 0 & -2 & 0 \\ 2 & -2 & 0 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -2 & 6 \\ -4 & -6 & 6 \\ -3 & -3 & 4 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: III}}$

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Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \left(\begin{pmatrix} -7 & -6 & -7 \\ -6 & -3 & -6 \\ 2 & 6 & 2 \end{pmatrix}\right) \qquad (b)\ \begin{pmatrix} 1 & 0 & -4 \\ 2 & -3 & -2 \\ 2 & 0 & -5 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -1 & 0 & 2 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 1 & 0 \\ -1 & -3 & 0 \\ 1 & 1 & -2 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -6 & 4 & 4 \\ -2 & 0 & 2 \\ -1 & 0 & 0 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: IV

Indian Institute of Technology, Bhubaneswar

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[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -7 & -6 & 5 \\ 7 & 6 & -5 \\ -4 & -4 & 4 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -5 & 0 & 4 \\ -2 & -1 & 2 \\ -2 & 0 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 2 & -2 \\ 0 & -2 & 1 \\ 0 & -1 & 0 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & 0 & -6 \\ 3 & -2 & -3 \\ 8 & -4 & -8 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: V

Indian Institute of Technology, Bhubaneswar

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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -7 & -3 & -5 \\ 7 & 3 & 5 \\ -1 & -1 & 1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -6 & -2 & 4 \\ 6 & 1 & -6 \\ -2 & -1 & 0 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -2 & 4 & -1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & -3 \\ -1 & 0 & 1 \\ 4 & -2 & -5 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: VI}}$

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[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -6 & -8 & 5 \\ 7 & 9 & -5 \\ -6 & -6 & 7 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -4 & 6 & 0 \\ -1 & 1 & 0 \\ 0 & 0 & -1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & 1 \\ 4 & -5 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -3 & 6 & -1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 0 & 1 & 0 \\ -1 & 2 & 0 \\ 2 & -3 & 1 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: VII}}$

Indian Institute of Technology, Bhubaneswar

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A. K. Kapoor
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[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -6 & -6 & 3 \\ 5 & 5 & -3 \\ -4 & -4 & 3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 7 & -8 & -4 \\ 0 & -1 & 0 \\ 8 & -8 & -5 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 2 & 0 & 3 \\ 3 & -1 & 3 \\ 6 & -6 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & -8 & 4 \\ 0 & -5 & 2 \\ 0 & -8 & 3 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & 0 \\ -2 & 1 & -1 \\ 2 & 3 & 3 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: VIII}}$

Indian Institute of Technology, Bhubaneswar

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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -6 & -5 & 4 \\ 6 & 5 & -4 \\ -3 & -3 & 3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -2 & 1 & -3 \\ 1 & -2 & 3 \\ 1 & -1 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -2 & -6 & 3 \\ 4 & 0 & 5 \\ 2 & 4 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 3 & -4 & 0 \\ 1 & -1 & 0 \\ 2 & -4 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -6 & -3 \\ 8 & 8 & 4 \\ 0 & 3 & 2 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: IX}}$

Indian Institute of Technology, Bhubaneswar

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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -6 & 0 & -2 \\ -3 & 0 & -3 \\ 3 & 0 & -1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -1 & -2 & 6 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -4 & -8 & -7 \\ 1 & -3 & 1 \\ 3 & 7 & 6 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 3 & 1 & -6 \\ 0 & 0 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & -1 & -1 \\ 2 & -1 & -2 \\ -3 & 7 & 6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: X}}$

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Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$(a)\ \begin{pmatrix} -6 & 5 & -6 \\ -6 & 5 & -6 \\ 4 & -4 & 2 \end{pmatrix}$ $\quad (b)\ \begin{pmatrix} -1 & 2 & 0 \\ -1 & 2 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ $\quad (c)\ \begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$

$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 3 & -6 & 1 \end{pmatrix}$ $\quad (e)\ \begin{pmatrix} 2 & 2 & 1 \\ 3 & 0 & -3 \\ -4 & 5 & 7 \end{pmatrix}$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: XI

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A. K. Kapoor
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(Due on August 5, 2015)

Assignment -I | Mathematical Physics | MM: 20

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -6 & 8 & -6 \\ -8 & 9 & -8 \\ 3 & -4 & 3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -3 & -8 & 8 \\ 0 & 1 & -4 \\ 0 & 0 & -3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -1 & 0 & 2 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 2 & -8 & -4 \\ 0 & -2 & -2 \\ 0 & 8 & 6 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -1 & 1 & 2 \\ 2 & -2 & 5 \\ -2 & -1 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: XII

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M.Sc. Ist Semester 2015-16

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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -5 & -9 & 2 \\ 2 & 6 & -2 \\ -5 & -5 & 2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & -6 & -3 \\ 0 & -1 & -1 \\ 0 & 2 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 2 & 1 & 2 \\ 1 & 2 & -2 \\ -1 & 1 & 5 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 0 & 2 & 4 \\ -1 & 0 & 1 \\ -2 & -2 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XIII}}$

Indian Institute of Technology, Bhubaneswar

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A. K. Kapoor
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Assignment -I | Mathematical Physics | MM: 20

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -5 & -7 & 1 \\ 5 & 7 & -1 \\ -3 & -3 & 3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 2 & 2 & 0 \\ 0 & 1 & 0 \\ -2 & -4 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 7 & -4 & -2 \\ 4 & -1 & -2 \\ 0 & 0 & 3 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -2 & 6 \\ -4 & -6 & 6 \\ -3 & -3 & 4 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: XIV

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$(a)\ \begin{pmatrix} -5 & -6 & 0 \\ 4 & -3 & 4 \\ 6 & 6 & 1 \end{pmatrix}$ $\quad (b)\ \begin{pmatrix} -2 & 4 & 0 \\ 0 & 2 & 0 \\ -4 & 4 & 2 \end{pmatrix}$ $\quad (c)\ \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & 1 \\ 4 & -5 & -1 \end{pmatrix}$

$(d)\ \begin{pmatrix} -1 & 2 & 2 \\ -1 & -4 & -1 \\ -1 & -1 & -4 \end{pmatrix}$ $\quad (e)\ \begin{pmatrix} -6 & 4 & 4 \\ -2 & 0 & 2 \\ -1 & 0 & 0 \end{pmatrix}$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XV}}$

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -5 & -3 & 3 \\ 2 & 0 & -2 \\ -6 & -6 & 2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 2 & 0 & 0 \\ 8 & -2 & -4 \\ -4 & 2 & 4 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 2 & 0 & 3 \\ 3 & -1 & 3 \\ 6 & -6 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & -3 & 6 \\ -1 & -1 & -2 \\ -2 & 2 & -6 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & 0 & -6 \\ 3 & -2 & -3 \\ 8 & -4 & -8 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XVI}}$

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Assignment -I | **Mathematical Physics** | **MM: 20**

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -5 & 0 & -2 \\ -3 & 1 & -3 \\ 3 & 0 & 0 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & -1 & 0 \\ 0 & 2 & 0 \\ -1 & -1 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -2 & -6 & 3 \\ 4 & 0 & 5 \\ 2 & 4 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -4 & 2 & -2 \\ 0 & -2 & 0 \\ 2 & -2 & 0 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & -3 \\ -1 & 0 & 1 \\ 4 & -2 & -5 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: XVII

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$(a)\ \begin{pmatrix} -5 & 5 & 5 \\ -2 & 4 & 3 \\ -8 & 6 & 7 \end{pmatrix}$ $\quad (b)\ \begin{pmatrix} 6 & -4 & 1 \\ 3 & -1 & 1 \\ 0 & 0 & 3 \end{pmatrix}$ $\quad (c)\ \begin{pmatrix} -4 & -8 & -7 \\ 1 & -3 & 1 \\ 3 & 7 & 6 \end{pmatrix}$

$(d)\ \begin{pmatrix} -1 & 1 & 0 \\ -1 & -3 & 0 \\ 1 & 1 & -2 \end{pmatrix}$ $\quad (e)\ \begin{pmatrix} 0 & 1 & 0 \\ -1 & 2 & 0 \\ 2 & -3 & 1 \end{pmatrix}$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XVIII}}$

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$(a)\ \begin{pmatrix} -5 & 6 & -4 \\ -6 & 6 & -6 \\ 2 & -3 & 1 \end{pmatrix}$ $(b)\ \begin{pmatrix} 3 & -2 & -2 \\ 0 & 3 & 0 \\ 0 & -2 & 1 \end{pmatrix}$ $(c)\ \begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$

$(d)\ \begin{pmatrix} -1 & 2 & -2 \\ 0 & -2 & 1 \\ 0 & -1 & 0 \end{pmatrix}$ $(e)\ \begin{pmatrix} 2 & -1 & 0 \\ -2 & 1 & -1 \\ 2 & 3 & 3 \end{pmatrix}$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: XIX

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a) \begin{pmatrix} -4 & -6 & 3 \\ 5 & 7 & -3 \\ -4 & -4 & 5 \end{pmatrix} \qquad (b) \begin{pmatrix} 5 & 0 & 2 \\ 2 & 3 & 2 \\ -4 & 0 & -1 \end{pmatrix} \qquad (c) \begin{pmatrix} -1 & 0 & 2 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix}$$

$$(d) \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -2 & 4 & -1 \end{pmatrix} \qquad (e) \begin{pmatrix} -4 & -6 & -3 \\ 8 & 8 & 4 \\ 0 & 3 & 2 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XX}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
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M.Sc. Ist Semester 2015-16

A. K. Kapoor
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(Due on August 5, 2015)

Assignment -I | Mathematical Physics | MM: 20

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -4 & -5 & 3 \\ 7 & 8 & -3 \\ 5 & 5 & -2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & -1 & 0 \\ 2 & 4 & 0 \\ 4 & 2 & 3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -3 & 6 & -1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & -1 & -1 \\ 2 & -1 & -2 \\ -3 & 7 & 6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

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Indian Institute of Technology, Bhubaneswar

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$$(a)\ \begin{pmatrix} -4 & -4 & -2 \\ 7 & 7 & 2 \\ 1 & 1 & 2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -3 & 4 & 4 \\ 0 & -3 & 0 \\ 0 & 2 & -1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & -8 & 4 \\ 0 & -5 & 2 \\ 0 & -8 & 3 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & 2 & 1 \\ 3 & 0 & -3 \\ -4 & 5 & 7 \end{pmatrix}$$

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- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -4 & -4 & 1 \\ -3 & -3 & 3 \\ -6 & -6 & 3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 0 & 0 & 3 \\ -2 & -2 & -3 \\ -2 & 0 & -5 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & 1 \\ 4 & -5 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 3 & -4 & 0 \\ 1 & -1 & 0 \\ 2 & -4 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -1 & 1 & 2 \\ 2 & -2 & 5 \\ -2 & -1 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

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- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -4 & -4 & 5 \\ 3 & 3 & -5 \\ 4 & 4 & -5 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -7 & 5 & -5 \\ -5 & 3 & -5 \\ 5 & -5 & 3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 2 & 0 & 3 \\ 3 & -1 & 3 \\ 6 & -6 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 3 & 1 & -6 \\ 0 & 0 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 0 & 2 & 4 \\ -1 & 0 & 1 \\ -2 & -2 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -4 & -3 & -1 \\ -2 & 3 & -2 \\ 2 & 6 & -1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & 0 & -4 \\ 2 & -3 & -2 \\ 2 & 0 & -5 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -2 & -6 & 3 \\ 4 & 0 & 5 \\ 2 & 4 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 3 & -6 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -2 & 6 \\ -4 & -6 & 6 \\ -3 & -3 & 4 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

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Indian Institute of Technology, Bhubaneswar

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M.Sc. Ist Semester 2015-16

A. K. Kapoor

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -4 & -2 & -5 \\ 2 & 0 & 2 \\ 2 & 2 & 3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -5 & 0 & 4 \\ -2 & -1 & 2 \\ -2 & 0 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -4 & -8 & -7 \\ 1 & -3 & 1 \\ 3 & 7 & 6 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 2 & -8 & -4 \\ 0 & -2 & -2 \\ 0 & 8 & 6 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -6 & 4 & 4 \\ -2 & 0 & 2 \\ -1 & 0 & 0 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

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- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\begin{pmatrix}-4 & -1 & -3\\ 3 & 0 & 3\\ -1 & -1 & 0\end{pmatrix}\qquad (b)\begin{pmatrix}-6 & -2 & 4\\ 6 & 1 & -6\\ -2 & -1 & 0\end{pmatrix}\qquad (c)\begin{pmatrix}-3 & -2 & 3\\ -2 & -3 & 3\\ -4 & -8 & 7\end{pmatrix}$$

$$(d)\begin{pmatrix}2 & 1 & 2\\ 1 & 2 & -2\\ -1 & 1 & 5\end{pmatrix}\qquad (e)\begin{pmatrix}4 & 0 & -6\\ 3 & -2 & -3\\ 8 & -4 & -8\end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -4 & -1 & 2 \\ -4 & -1 & 2 \\ -5 & 1 & 1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -4 & 6 & 0 \\ -1 & 1 & 0 \\ 0 & 0 & -1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -1 & 0 & 2 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 7 & -4 & -2 \\ 4 & -1 & -2 \\ 0 & 0 & 3 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & -3 \\ -1 & 0 & 1 \\ 4 & -2 & -5 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

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Indian Institute of Technology, Bhubaneswar

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a) \begin{pmatrix} -4 & 0 & -6 \\ 4 & 0 & 6 \\ 1 & 0 & 1 \end{pmatrix} \qquad (b) \begin{pmatrix} 7 & -8 & -4 \\ 0 & -1 & 0 \\ 8 & -8 & -5 \end{pmatrix} \qquad (c) \begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d) \begin{pmatrix} -1 & 2 & 2 \\ -1 & -4 & -1 \\ -1 & -1 & -4 \end{pmatrix} \qquad (e) \begin{pmatrix} 0 & 1 & 0 \\ -1 & 2 & 0 \\ 2 & -3 & 1 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

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Indian Institute of Technology, Bhubaneswar

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- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\begin{pmatrix}-4 & 2 & 2\\ -4 & 2 & 2\\ 4 & -4 & -4\end{pmatrix}\qquad (b)\begin{pmatrix}-2 & 1 & -3\\ 1 & -2 & 3\\ 1 & -1 & 2\end{pmatrix}\qquad (c)\begin{pmatrix}3 & -1 & -1\\ 0 & 2 & -1\\ 1 & -1 & 3\end{pmatrix}$$

$$(d)\begin{pmatrix}1 & -3 & 6\\ -1 & -1 & -2\\ -2 & 2 & -6\end{pmatrix}\qquad (e)\begin{pmatrix}2 & -1 & 0\\ -2 & 1 & -1\\ 2 & 3 & 3\end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: XXX

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- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$(a)\ \begin{pmatrix} -4 & 4 & 4 \\ -7 & 7 & 4 \\ 7 & -7 & -4 \end{pmatrix}$ $\quad (b)\ \begin{pmatrix} -1 & -2 & 6 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix}$ $\quad (c)\ \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & 1 \\ 4 & -5 & -1 \end{pmatrix}$

$(d)\ \begin{pmatrix} -4 & 2 & -2 \\ 0 & -2 & 0 \\ 2 & -2 & 0 \end{pmatrix}$ $\quad (e)\ \begin{pmatrix} -4 & -6 & -3 \\ 8 & 8 & 4 \\ 0 & 3 & 2 \end{pmatrix}$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

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- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -4 & 4 & 4 \\ -5 & 5 & 4 \\ 5 & -5 & -4 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -1 & 2 & 0 \\ -1 & 2 & 0 \\ 0 & 0 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 2 & 0 & 3 \\ 3 & -1 & 3 \\ 6 & -6 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 1 & 0 \\ -1 & -3 & 0 \\ 1 & 1 & -2 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & -1 & -1 \\ 2 & -1 & -2 \\ -3 & 7 & 6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

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M.Sc. Ist Semester 2015-16

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- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\begin{pmatrix}-4 & 6 & 6\\ -2 & 4 & 5\\ -2 & 2 & 1\end{pmatrix} \qquad (b)\begin{pmatrix}-3 & -8 & 8\\ 0 & 1 & -4\\ 0 & 0 & -3\end{pmatrix} \qquad (c)\begin{pmatrix}-2 & -6 & 3\\ 4 & 0 & 5\\ 2 & 4 & -1\end{pmatrix}$$

$$(d)\begin{pmatrix}-1 & 2 & -2\\ 0 & -2 & 1\\ 0 & -1 & 0\end{pmatrix} \qquad (e)\begin{pmatrix}2 & 2 & 1\\ 3 & 0 & -3\\ -4 & 5 & 7\end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

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- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -4 & 6 & 6 \\ 2 & 0 & 3 \\ -6 & 6 & 3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & -6 & -3 \\ 0 & -1 & -1 \\ 0 & 2 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -4 & -8 & -7 \\ 1 & -3 & 1 \\ 3 & 7 & 6 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -2 & 4 & -1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -1 & 1 & 2 \\ 2 & -2 & 5 \\ -2 & -1 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

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- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a) \begin{pmatrix} -3 & -7 & 1 \\ 1 & 5 & -1 \\ -5 & -5 & 3 \end{pmatrix} \qquad (b) \begin{pmatrix} 2 & 2 & 0 \\ 0 & 1 & 0 \\ -2 & -4 & 1 \end{pmatrix} \qquad (c) \begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$$

$$(d) \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -3 & 6 & -1 \end{pmatrix} \qquad (e) \begin{pmatrix} 0 & 2 & 4 \\ -1 & 0 & 1 \\ -2 & -2 & -6 \end{pmatrix}$$

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -3 & -6 & -4 \\ -5 & -2 & -5 \\ 6 & 6 & 7 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -2 & 4 & 0 \\ 0 & 2 & 0 \\ -4 & 4 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -1 & 0 & 2 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & -8 & 4 \\ 0 & -5 & 2 \\ 0 & -8 & 3 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -2 & 6 \\ -4 & -6 & 6 \\ -3 & -3 & 4 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

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- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a) \begin{pmatrix} -3 & -4 & -6 \\ 5 & 6 & 6 \\ 5 & 5 & 7 \end{pmatrix} \qquad (b) \begin{pmatrix} 2 & 0 & 0 \\ 8 & -2 & -4 \\ -4 & 2 & 4 \end{pmatrix} \qquad (c) \begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d) \begin{pmatrix} 3 & -4 & 0 \\ 1 & -1 & 0 \\ 2 & -4 & 1 \end{pmatrix} \qquad (e) \begin{pmatrix} -6 & 4 & 4 \\ -2 & 0 & 2 \\ -1 & 0 & 0 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

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M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -3 & -4 & -5 \\ -1 & 0 & -1 \\ 4 & 4 & 6 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & -1 & 0 \\ 0 & 2 & 0 \\ -1 & -1 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 3 & 1 & -6 \\ 0 & 0 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & 0 & -6 \\ 3 & -2 & -3 \\ 8 & -4 & -8 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: XXXVIII

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences

Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor

email:akkhcu@gmail.com

(Due on August 5, 2015)

Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -3 & -3 & -5 \\ 4 & 4 & 5 \\ 4 & 4 & 5 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 6 & -4 & 1 \\ 3 & -1 & 1 \\ 0 & 0 & 3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & 1 \\ 4 & -5 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 3 & -6 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & -3 \\ -1 & 0 & 1 \\ 4 & -2 & -5 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: XXXIX

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\begin{pmatrix}-3 & -3 & 0\\ 4 & 2 & 2\\ 3 & -3 & 6\end{pmatrix} \qquad (b)\begin{pmatrix}3 & -2 & -2\\ 0 & 3 & 0\\ 0 & -2 & 1\end{pmatrix} \qquad (c)\begin{pmatrix}2 & 0 & 3\\ 3 & -1 & 3\\ 6 & -6 & 2\end{pmatrix}$$

$$(d)\begin{pmatrix}2 & -8 & -4\\ 0 & -2 & -2\\ 0 & 8 & 6\end{pmatrix} \qquad (e)\begin{pmatrix}0 & 1 & 0\\ -1 & 2 & 0\\ 2 & -3 & 1\end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XL}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -3 & 0 & -8 \\ 1 & -2 & 8 \\ 4 & 0 & 9 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 5 & 0 & 2 \\ 2 & 3 & 2 \\ -4 & 0 & -1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -2 & -6 & 3 \\ 4 & 0 & 5 \\ 2 & 4 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 2 & 1 & 2 \\ 1 & 2 & -2 \\ -1 & 1 & 5 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & 0 \\ -2 & 1 & -1 \\ 2 & 3 & 3 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XLI}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
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Assignment -I | **Mathematical Physics** | **MM: 20**

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\begin{pmatrix}-3 & 1 & 1\\ 5 & -3 & -3\\ -7 & 3 & 3\end{pmatrix} \qquad (b)\begin{pmatrix}1 & -1 & 0\\ 2 & 4 & 0\\ 4 & 2 & 3\end{pmatrix} \qquad (c)\begin{pmatrix}-4 & -8 & -7\\ 1 & -3 & 1\\ 3 & 7 & 6\end{pmatrix}$$

$$(d)\begin{pmatrix}7 & -4 & -2\\ 4 & -1 & -2\\ 0 & 0 & 3\end{pmatrix} \qquad (e)\begin{pmatrix}-4 & -6 & -3\\ 8 & 8 & 4\\ 0 & 3 & 2\end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: XLII

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I $\boxed{\text{Mathematical Physics}}$ MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -3 & 5 & 5 \\ 6 & -4 & 1 \\ -6 & 6 & 1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -3 & 4 & 4 \\ 0 & -3 & 0 \\ 0 & 2 & -1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 2 & 2 \\ -1 & -4 & -1 \\ -1 & -1 & -4 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & -1 & -1 \\ 2 & -1 & -2 \\ -3 & 7 & 6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XLIII}}$

Indian Institute of Technology, Bhubaneswar

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Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
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Assignment -I | **Mathematical Physics** | **MM: 20**

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\begin{pmatrix}-3 & 6 & -2\\ 4 & 2 & 4\\ 7 & -6 & 6\end{pmatrix}\qquad (b)\begin{pmatrix}0 & 0 & 3\\ -2 & -2 & -3\\ -2 & 0 & -5\end{pmatrix}\qquad (c)\begin{pmatrix}-1 & 0 & 2\\ 0 & -3 & 6\\ 0 & -1 & 2\end{pmatrix}$$

$$(d)\begin{pmatrix}1 & -3 & 6\\ -1 & -1 & -2\\ -2 & 2 & -6\end{pmatrix}\qquad (e)\begin{pmatrix}2 & 2 & 1\\ 3 & 0 & -3\\ -4 & 5 & 7\end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: XLIV

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -2 & -5 & 1 \\ 1 & 4 & -1 \\ -3 & -3 & 2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -7 & 5 & -5 \\ -5 & 3 & -5 \\ 5 & -5 & 3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -4 & 2 & -2 \\ 0 & -2 & 0 \\ 2 & -2 & 0 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -1 & 1 & 2 \\ 2 & -2 & 5 \\ -2 & -1 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XLV}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -2 & -3 & 1 \\ 5 & 6 & -1 \\ 3 & 3 & 0 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & 0 & -4 \\ 2 & -3 & -2 \\ 2 & 0 & -5 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 1 & 0 \\ -1 & -3 & 0 \\ 1 & 1 & -2 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 0 & 2 & 4 \\ -1 & 0 & 1 \\ -2 & -2 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XLVI}}$

Indian Institute of Technology, Bhubaneswar
School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -2 & -1 & -5 \\ 4 & 3 & 5 \\ -2 & -2 & 4 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -5 & 0 & 4 \\ -2 & -1 & 2 \\ -2 & 0 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & 1 \\ 4 & -5 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 2 & -2 \\ 0 & -2 & 1 \\ 0 & -1 & 0 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -2 & 6 \\ -4 & -6 & 6 \\ -3 & -3 & 4 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XLVII}}$

Indian Institute of Technology, Bhubaneswar
School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$(a)\ \begin{pmatrix} -2 & 0 & -6 \\ 0 & -2 & 6 \\ 3 & 0 & 7 \end{pmatrix}$ $(b)\ \begin{pmatrix} -6 & -2 & 4 \\ 6 & 1 & -6 \\ -2 & -1 & 0 \end{pmatrix}$ $(c)\ \begin{pmatrix} 2 & 0 & 3 \\ 3 & -1 & 3 \\ 6 & -6 & 2 \end{pmatrix}$

$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -2 & 4 & -1 \end{pmatrix}$ $(e)\ \begin{pmatrix} -6 & 4 & 4 \\ -2 & 0 & 2 \\ -1 & 0 & 0 \end{pmatrix}$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: XLVIII

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -2 & 0 & -6 \\ 3 & 1 & 6 \\ 3 & 3 & 4 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -4 & 6 & 0 \\ -1 & 1 & 0 \\ 0 & 0 & -1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -2 & -6 & 3 \\ 4 & 0 & 5 \\ 2 & 4 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -3 & 6 & -1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & 0 & -6 \\ 3 & -2 & -3 \\ 8 & -4 & -8 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XLIX}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -2 & 0 & -4 \\ -1 & -3 & 4 \\ 2 & 0 & 4 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 7 & -8 & -4 \\ 0 & -1 & 0 \\ 8 & -8 & -5 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -4 & -8 & -7 \\ 1 & -3 & 1 \\ 3 & 7 & 6 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & -8 & 4 \\ 0 & -5 & 2 \\ 0 & -8 & 3 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & -3 \\ -1 & 0 & 1 \\ 4 & -2 & -5 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: L}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com

(Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -2 & 0 & 3 \\ -6 & 4 & 3 \\ -2 & 0 & 3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -2 & 1 & -3 \\ 1 & -2 & 3 \\ 1 & -1 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 3 & -4 & 0 \\ 1 & -1 & 0 \\ 2 & -4 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 0 & 1 & 0 \\ -1 & 2 & 0 \\ 2 & -3 & 1 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: LI}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -2 & 0 & 3 \\ 0 & -2 & 6 \\ -2 & 0 & 3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -1 & -2 & 6 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -1 & 0 & 2 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 3 & 1 & -6 \\ 0 & 0 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & 0 \\ -2 & 1 & -1 \\ 2 & 3 & 3 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: LII}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -2 & 1 & 1 \\ -2 & 1 & 1 \\ 2 & -2 & -2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -1 & 2 & 0 \\ -1 & 2 & 0 \\ 0 & 0 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 3 & -6 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -6 & -3 \\ 8 & 8 & 4 \\ 0 & 3 & 2 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: LIII

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -2 & 2 & -6 \\ 2 & -2 & 6 \\ 2 & 2 & 2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -3 & -8 & 8 \\ 0 & 1 & -4 \\ 0 & 0 & -3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 2 & -8 & -4 \\ 0 & -2 & -2 \\ 0 & 8 & 6 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & -1 & -1 \\ 2 & -1 & -2 \\ -3 & 7 & 6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: LIV}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -2 & 2 & -2 \\ -5 & 6 & -7 \\ -1 & 2 & -3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & -6 & -3 \\ 0 & -1 & -1 \\ 0 & 2 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & 1 \\ 4 & -5 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 2 & 1 & 2 \\ 1 & 2 & -2 \\ -1 & 1 & 5 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & 2 & 1 \\ 3 & 0 & -3 \\ -4 & 5 & 7 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: LV}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -2 & 3 & 3 \\ 2 & -1 & 1 \\ -4 & 4 & 2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 2 & 2 & 0 \\ 0 & 1 & 0 \\ -2 & -4 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 2 & 0 & 3 \\ 3 & -1 & 3 \\ 6 & -6 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 7 & -4 & -2 \\ 4 & -1 & -2 \\ 0 & 0 & 3 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -1 & 1 & 2 \\ 2 & -2 & 5 \\ -2 & -1 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: LVI

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -2 & 3 & 3 \\ 4 & -3 & 0 \\ -6 & 6 & 3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -2 & 4 & 0 \\ 0 & 2 & 0 \\ -4 & 4 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -2 & -6 & 3 \\ 4 & 0 & 5 \\ 2 & 4 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 2 & 2 \\ -1 & -4 & -1 \\ -1 & -1 & -4 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 0 & 2 & 4 \\ -1 & 0 & 1 \\ -2 & -2 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -1 & -3 & -3 \\ 1 & 3 & 3 \\ 1 & 1 & -1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 2 & 0 & 0 \\ 8 & -2 & -4 \\ -4 & 2 & 4 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -4 & -8 & -7 \\ 1 & -3 & 1 \\ 3 & 7 & 6 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & -3 & 6 \\ -1 & -1 & -2 \\ -2 & 2 & -6 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -2 & 6 \\ -4 & -6 & 6 \\ -3 & -3 & 4 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -1 & -3 & 1 \\ 1 & -1 & 1 \\ 1 & 3 & -1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & -1 & 0 \\ 0 & 2 & 0 \\ -1 & -1 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -4 & 2 & -2 \\ 0 & -2 & 0 \\ 2 & -2 & 0 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -6 & 4 & 4 \\ -2 & 0 & 2 \\ -1 & 0 & 0 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

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Indian Institute of Technology, Bhubaneswar

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A. K. Kapoor
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Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -1 & -2 & -4 \\ 3 & 4 & 4 \\ 3 & 3 & 5 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 6 & -4 & 1 \\ 3 & -1 & 1 \\ 0 & 0 & 3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -1 & 0 & 2 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 1 & 0 \\ -1 & -3 & 0 \\ 1 & 1 & -2 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & 0 & -6 \\ 3 & -2 & -3 \\ 8 & -4 & -8 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: LX

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
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[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -1 & -2 & -2 \\ -1 & -2 & -2 \\ 1 & -1 & -1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 3 & -2 & -2 \\ 0 & 3 & 0 \\ 0 & -2 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 2 & -2 \\ 0 & -2 & 1 \\ 0 & -1 & 0 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & -3 \\ -1 & 0 & 1 \\ 4 & -2 & -5 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: LXI}}$

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A. K. Kapoor

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -1 & -1 & -3 \\ -3 & -3 & 3 \\ -7 & -7 & 3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 5 & 0 & 2 \\ 2 & 3 & 2 \\ -4 & 0 & -1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -2 & 4 & -1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 0 & 1 & 0 \\ -1 & 2 & 0 \\ 2 & -3 & 1 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: LXII

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Department of Physics

M.Sc. Ist Semester 2015-16

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -1 & -1 & -3 \\ 2 & 2 & 3 \\ 2 & 2 & 3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & -1 & 0 \\ 2 & 4 & 0 \\ 4 & 2 & 3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & 1 \\ 4 & -5 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -3 & 6 & -1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & 0 \\ -2 & 1 & -1 \\ 2 & 3 & 3 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -1 & 0 & -8 \\ 4 & 3 & 8 \\ -4 & -4 & 7 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -3 & 4 & 4 \\ 0 & -3 & 0 \\ 0 & 2 & -1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 2 & 0 & 3 \\ 3 & -1 & 3 \\ 6 & -6 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & -8 & 4 \\ 0 & -5 & 2 \\ 0 & -8 & 3 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -6 & -3 \\ 8 & 8 & 4 \\ 0 & 3 & 2 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\begin{pmatrix}-1 & 0 & -6\\ 3 & 2 & 6\\ -3 & -3 & 5\end{pmatrix}\qquad (b)\begin{pmatrix}0 & 0 & 3\\ -2 & -2 & -3\\ -2 & 0 & -5\end{pmatrix}\qquad (c)\begin{pmatrix}-2 & -6 & 3\\ 4 & 0 & 5\\ 2 & 4 & -1\end{pmatrix}$$

$$(d)\begin{pmatrix}3 & -4 & 0\\ 1 & -1 & 0\\ 2 & -4 & 1\end{pmatrix}\qquad (e)\begin{pmatrix}4 & -1 & -1\\ 2 & -1 & -2\\ -3 & 7 & 6\end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: LXV}}$

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -1 & 0 & -1 \\ 3 & 4 & -3 \\ 6 & 0 & 4 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -7 & 5 & -5 \\ -5 & 3 & -5 \\ 5 & -5 & 3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -4 & -8 & -7 \\ 1 & -3 & 1 \\ 3 & 7 & 6 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 3 & 1 & -6 \\ 0 & 0 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & 2 & 1 \\ 3 & 0 & -3 \\ -4 & 5 & 7 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$(a)\ \begin{pmatrix} -1 & 2 & 3 \\ 5 & 2 & 3 \\ -4 & -4 & -6 \end{pmatrix}$ $\quad (b)\ \begin{pmatrix} 1 & 0 & -4 \\ 2 & -3 & -2 \\ 2 & 0 & -5 \end{pmatrix}$ $\quad (c)\ \begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$

$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 3 & -6 & 1 \end{pmatrix}$ $\quad (e)\ \begin{pmatrix} -1 & 1 & 2 \\ 2 & -2 & 5 \\ -2 & -1 & -6 \end{pmatrix}$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: LXVII

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\begin{pmatrix}-1 & 3 & -7\\ -1 & -5 & 7\\ -5 & -5 & 3\end{pmatrix} \qquad (b)\begin{pmatrix}-5 & 0 & 4\\ -2 & -1 & 2\\ -2 & 0 & 1\end{pmatrix} \qquad (c)\begin{pmatrix}-1 & 0 & 2\\ 0 & -3 & 6\\ 0 & -1 & 2\end{pmatrix}$$

$$(d)\begin{pmatrix}2 & -8 & -4\\ 0 & -2 & -2\\ 0 & 8 & 6\end{pmatrix} \qquad (e)\begin{pmatrix}0 & 2 & 4\\ -1 & 0 & 1\\ -2 & -2 & -6\end{pmatrix}$$

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -1 & 3 & -1 \\ 1 & -3 & 1 \\ -1 & -3 & -1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -6 & -2 & 4 \\ 6 & 1 & -6 \\ -2 & -1 & 0 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 2 & 1 & 2 \\ 1 & 2 & -2 \\ -1 & 1 & 5 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -2 & 6 \\ -4 & -6 & 6 \\ -3 & -3 & 4 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} -1 & 6 & 1 \\ 0 & 7 & -2 \\ 0 & 6 & 0 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -4 & 6 & 0 \\ -1 & 1 & 0 \\ 0 & 0 & -1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 7 & -4 & -2 \\ 4 & -1 & -2 \\ 0 & 0 & 3 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -6 & 4 & 4 \\ -2 & 0 & 2 \\ -1 & 0 & 0 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: LXX}}$

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 0 & -6 & 5 \\ -3 & -3 & 5 \\ -2 & -8 & 9 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 7 & -8 & -4 \\ 0 & -1 & 0 \\ 8 & -8 & -5 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & 1 \\ 4 & -5 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 2 & 2 \\ -1 & -4 & -1 \\ -1 & -1 & -4 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & 0 & -6 \\ 3 & -2 & -3 \\ 8 & -4 & -8 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

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- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 0 & -3 & -3 \\ -1 & -2 & -3 \\ 1 & -1 & 0 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -2 & 1 & -3 \\ 1 & -2 & 3 \\ 1 & -1 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 2 & 0 & 3 \\ 3 & -1 & 3 \\ 6 & -6 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & -3 & 6 \\ -1 & -1 & -2 \\ -2 & 2 & -6 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & -3 \\ -1 & 0 & 1 \\ 4 & -2 & -5 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

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$$(a)\ \begin{pmatrix} 0 & -3 & 3 \\ -6 & 4 & -6 \\ -6 & 3 & -5 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -1 & -2 & 6 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -2 & -6 & 3 \\ 4 & 0 & 5 \\ 2 & 4 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -4 & 2 & -2 \\ 0 & -2 & 0 \\ 2 & -2 & 0 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 0 & 1 & 0 \\ -1 & 2 & 0 \\ 2 & -3 & 1 \end{pmatrix}$$

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- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 0 & -2 & -2 \\ -1 & -1 & -2 \\ 1 & -1 & 0 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -1 & 2 & 0 \\ -1 & 2 & 0 \\ 0 & 0 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -4 & -8 & -7 \\ 1 & -3 & 1 \\ 3 & 7 & 6 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 1 & 0 \\ -1 & -3 & 0 \\ 1 & 1 & -2 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & 0 \\ -2 & 1 & -1 \\ 2 & 3 & 3 \end{pmatrix}$$

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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 0 & 0 & -4 \\ 2 & 0 & 6 \\ 2 & 0 & 6 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -3 & -8 & 8 \\ 0 & 1 & -4 \\ 0 & 0 & -3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 2 & -2 \\ 0 & -2 & 1 \\ 0 & -1 & 0 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -6 & -3 \\ 8 & 8 & 4 \\ 0 & 3 & 2 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: LXXV}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences

Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor

email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix}0 & 0 & -4\\ 2 & 2 & 4\\ 2 & 2 & 4\end{pmatrix} \qquad (b)\ \begin{pmatrix}1 & -6 & -3\\ 0 & -1 & -1\\ 0 & 2 & 2\end{pmatrix} \qquad (c)\ \begin{pmatrix}-1 & 0 & 2\\ 0 & -3 & 6\\ 0 & -1 & 2\end{pmatrix}$$

$$(d)\ \begin{pmatrix}-3 & 4 & 0\\ -1 & 1 & 0\\ -2 & 4 & -1\end{pmatrix} \qquad (e)\ \begin{pmatrix}4 & -1 & -1\\ 2 & -1 & -2\\ -3 & 7 & 6\end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: LXXVI

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 0 & 1 & -4 \\ -4 & -5 & 4 \\ -7 & -7 & 3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 2 & 2 & 0 \\ 0 & 1 & 0 \\ -2 & -4 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -3 & 6 & -1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & 2 & 1 \\ 3 & 0 & -3 \\ -4 & 5 & 7 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: LXXVII}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 0 & 2 & 0 \\ 2 & 1 & 2 \\ 2 & -2 & 2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -2 & 4 & 0 \\ 0 & 2 & 0 \\ -4 & 4 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & -8 & 4 \\ 0 & -5 & 2 \\ 0 & -8 & 3 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -1 & 1 & 2 \\ 2 & -2 & 5 \\ -2 & -1 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: LXXVIII}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com

(Due on August 5, 2015)

Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$(a)\ \begin{pmatrix} 0 & 2 & 7 \\ 0 & 1 & -4 \\ 0 & 2 & 7 \end{pmatrix}$ $\quad (b)\ \begin{pmatrix} 2 & 0 & 0 \\ 8 & -2 & -4 \\ -4 & 2 & 4 \end{pmatrix}$ $\quad (c)\ \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & 1 \\ 4 & -5 & -1 \end{pmatrix}$

$(d)\ \begin{pmatrix} 3 & -4 & 0 \\ 1 & -1 & 0 \\ 2 & -4 & 1 \end{pmatrix}$ $\quad (e)\ \begin{pmatrix} 0 & 2 & 4 \\ -1 & 0 & 1 \\ -2 & -2 & -6 \end{pmatrix}$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: LXXIX

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences

Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor

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(Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 0 & 4 & -6 \\ -3 & -7 & 6 \\ -5 & -5 & 2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & -1 & 0 \\ 0 & 2 & 0 \\ -1 & -1 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 2 & 0 & 3 \\ 3 & -1 & 3 \\ 6 & -6 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 3 & 1 & -6 \\ 0 & 0 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -2 & 6 \\ -4 & -6 & 6 \\ -3 & -3 & 4 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: LXXX}}$

Indian Institute of Technology, Bhubaneswar

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Assignment -I | Mathematical Physics | MM: 20

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 0 & 4 & -6 \\ 1 & -3 & 6 \\ 1 & 1 & 2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 6 & -4 & 1 \\ 3 & -1 & 1 \\ 0 & 0 & 3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -2 & -6 & 3 \\ 4 & 0 & 5 \\ 2 & 4 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 3 & -6 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -6 & 4 & 4 \\ -2 & 0 & 2 \\ -1 & 0 & 0 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: LXXXI

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 0 & 4 & -4 \\ -6 & -2 & 0 \\ 0 & -8 & 8 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 3 & -2 & -2 \\ 0 & 3 & 0 \\ 0 & -2 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -4 & -8 & -7 \\ 1 & -3 & 1 \\ 3 & 7 & 6 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 2 & -8 & -4 \\ 0 & -2 & -2 \\ 0 & 8 & 6 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & 0 & -6 \\ 3 & -2 & -3 \\ 8 & -4 & -8 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: LXXXII

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\begin{pmatrix} 1 & -2 & 0 \\ -3 & 0 & -3 \\ 2 & 2 & 3 \end{pmatrix} \qquad (b)\begin{pmatrix} 5 & 0 & 2 \\ 2 & 3 & 2 \\ -4 & 0 & -1 \end{pmatrix} \qquad (c)\begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$$

$$(d)\begin{pmatrix} 2 & 1 & 2 \\ 1 & 2 & -2 \\ -1 & 1 & 5 \end{pmatrix} \qquad (e)\begin{pmatrix} 2 & -1 & -3 \\ -1 & 0 & 1 \\ 4 & -2 & -5 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: LXXXIII

Indian Institute of Technology, Bhubaneswar

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Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$(a)\ \begin{pmatrix} 1 & -1 & 1 \\ 5 & -3 & 1 \\ 3 & -1 & -1 \end{pmatrix}$ $\quad (b)\ \begin{pmatrix} 1 & -1 & 0 \\ 2 & 4 & 0 \\ 4 & 2 & 3 \end{pmatrix}$ $\quad (c)\ \begin{pmatrix} -1 & 0 & 2 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix}$

$(d)\ \begin{pmatrix} 7 & -4 & -2 \\ 4 & -1 & -2 \\ 0 & 0 & 3 \end{pmatrix}$ $\quad (e)\ \begin{pmatrix} 0 & 1 & 0 \\ -1 & 2 & 0 \\ 2 & -3 & 1 \end{pmatrix}$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: LXXXIV}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 1 & -1 & 2 \\ 0 & 2 & -2 \\ 1 & 1 & 0 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -3 & 4 & 4 \\ 0 & -3 & 0 \\ 0 & 2 & -1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 2 & 2 \\ -1 & -4 & -1 \\ -1 & -1 & -4 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & 0 \\ -2 & 1 & -1 \\ 2 & 3 & 3 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: LXXXV}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a) \begin{pmatrix} 1 & 0 & -4 \\ 2 & 3 & 4 \\ 2 & 2 & 5 \end{pmatrix} \qquad (b) \begin{pmatrix} 0 & 0 & 3 \\ -2 & -2 & -3 \\ -2 & 0 & -5 \end{pmatrix} \qquad (c) \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d) \begin{pmatrix} 1 & -3 & 6 \\ -1 & -1 & -2 \\ -2 & 2 & -6 \end{pmatrix} \qquad (e) \begin{pmatrix} -4 & -6 & -3 \\ 8 & 8 & 4 \\ 0 & 3 & 2 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: LXXXVI

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences

Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor

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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\begin{pmatrix}1 & 0 & -2\\ 1 & 0 & 4\\ 1 & 0 & 4\end{pmatrix}\qquad (b)\begin{pmatrix}-7 & 5 & -5\\ -5 & 3 & -5\\ 5 & -5 & 3\end{pmatrix}\qquad (c)\begin{pmatrix}4 & -1 & -1\\ -1 & 4 & 1\\ 4 & -5 & -1\end{pmatrix}$$

$$(d)\begin{pmatrix}-4 & 2 & -2\\ 0 & -2 & 0\\ 2 & -2 & 0\end{pmatrix}\qquad (e)\begin{pmatrix}4 & -1 & -1\\ 2 & -1 & -2\\ -3 & 7 & 6\end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: LXXXVII}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences

Department of Physics

M.Sc. Ist Semester 2015-16

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Assignment -I | Mathematical Physics | MM: 20

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a) \begin{pmatrix} 1 & 0 & 6 \\ -6 & -5 & -6 \\ 6 & 6 & -2 \end{pmatrix} \qquad (b) \begin{pmatrix} 1 & 0 & -4 \\ 2 & -3 & -2 \\ 2 & 0 & -5 \end{pmatrix} \qquad (c) \begin{pmatrix} 2 & 0 & 3 \\ 3 & -1 & 3 \\ 6 & -6 & 2 \end{pmatrix}$$

$$(d) \begin{pmatrix} -1 & 1 & 0 \\ -1 & -3 & 0 \\ 1 & 1 & -2 \end{pmatrix} \qquad (e) \begin{pmatrix} 2 & 2 & 1 \\ 3 & 0 & -3 \\ -4 & 5 & 7 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: LXXXVIII

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\begin{pmatrix}1 & 1 & -3\\ 0 & 0 & 3\\ -2 & -2 & 3\end{pmatrix} \qquad (b)\begin{pmatrix}-5 & 0 & 4\\ -2 & -1 & 2\\ -2 & 0 & 1\end{pmatrix} \qquad (c)\begin{pmatrix}-2 & -6 & 3\\ 4 & 0 & 5\\ 2 & 4 & -1\end{pmatrix}$$

$$(d)\begin{pmatrix}-1 & 2 & -2\\ 0 & -2 & 1\\ 0 & -1 & 0\end{pmatrix} \qquad (e)\begin{pmatrix}-1 & 1 & 2\\ 2 & -2 & 5\\ -2 & -1 & -6\end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: LXXXIX

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 1 & 1 & -3 \\ 1 & 1 & 3 \\ 1 & 1 & 3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -6 & -2 & 4 \\ 6 & 1 & -6 \\ -2 & -1 & 0 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -4 & -8 & -7 \\ 1 & -3 & 1 \\ 3 & 7 & 6 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -2 & 4 & -1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 0 & 2 & 4 \\ -1 & 0 & 1 \\ -2 & -2 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: XC

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 1 & 1 & -1 \\ -1 & -1 & 1 \\ 5 & -1 & -5 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -4 & 6 & 0 \\ -1 & 1 & 0 \\ 0 & 0 & -1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -3 & 6 & -1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -2 & 6 \\ -4 & -6 & 6 \\ -3 & -3 & 4 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XCI}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\begin{pmatrix} 1 & 1 & 1 \\ 0 & -3 & -6 \\ -2 & 1 & 4 \end{pmatrix} \qquad (b)\begin{pmatrix} 7 & -8 & -4 \\ 0 & -1 & 0 \\ 8 & -8 & -5 \end{pmatrix} \qquad (c)\begin{pmatrix} -1 & 0 & 2 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix}$$

$$(d)\begin{pmatrix} -1 & -8 & 4 \\ 0 & -5 & 2 \\ 0 & -8 & 3 \end{pmatrix} \qquad (e)\begin{pmatrix} -6 & 4 & 4 \\ -2 & 0 & 2 \\ -1 & 0 & 0 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: XCII

Indian Institute of Technology, Bhubaneswar

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Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
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Assignment -I | **Mathematical Physics** | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a) \begin{pmatrix} 1 & 2 & -8 \\ 1 & 0 & 8 \\ -5 & -5 & 7 \end{pmatrix} \qquad (b) \begin{pmatrix} -2 & 1 & -3 \\ 1 & -2 & 3 \\ 1 & -1 & 2 \end{pmatrix} \qquad (c) \begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d) \begin{pmatrix} 3 & -4 & 0 \\ 1 & -1 & 0 \\ 2 & -4 & 1 \end{pmatrix} \qquad (e) \begin{pmatrix} 4 & 0 & -6 \\ 3 & -2 & -3 \\ 8 & -4 & -8 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: XCIII

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School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 1 & 2 & -2 \\ -3 & 9 & -9 \\ 1 & 2 & -2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -1 & -2 & 6 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 3 & 1 & -6 \\ 0 & 0 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & -3 \\ -1 & 0 & 1 \\ 4 & -2 & -5 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XCIV}}$

Indian Institute of Technology, Bhubaneswar

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 1 & 2 & 3 \\ 0 & -6 & -6 \\ 0 & 4 & 4 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -1 & 2 & 0 \\ -1 & 2 & 0 \\ 0 & 0 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & 1 \\ 4 & -5 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 3 & -6 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 0 & 1 & 0 \\ -1 & 2 & 0 \\ 2 & -3 & 1 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XCV}}$

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 1 & 3 & 3 \\ -9 & 1 & -3 \\ 9 & -3 & 1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -3 & -8 & 8 \\ 0 & 1 & -4 \\ 0 & 0 & -3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 2 & 0 & 3 \\ 3 & -1 & 3 \\ 6 & -6 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 2 & -8 & -4 \\ 0 & -2 & -2 \\ 0 & 8 & 6 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & 0 \\ -2 & 1 & -1 \\ 2 & 3 & 3 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XCVI}}$

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Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 1 & 4 & 2 \\ -4 & 6 & -4 \\ -1 & -2 & -2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & -6 & -3 \\ 0 & -1 & -1 \\ 0 & 2 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -2 & -6 & 3 \\ 4 & 0 & 5 \\ 2 & 4 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 2 & 1 & 2 \\ 1 & 2 & -2 \\ -1 & 1 & 5 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -6 & -3 \\ 8 & 8 & 4 \\ 0 & 3 & 2 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: XCVII

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[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\begin{pmatrix}2 & -5 & 3\\ 1 & -4 & 3\\ 3 & -9 & 6\end{pmatrix}\qquad (b)\begin{pmatrix}2 & 2 & 0\\ 0 & 1 & 0\\ -2 & -4 & 1\end{pmatrix}\qquad (c)\begin{pmatrix}-4 & -8 & -7\\ 1 & -3 & 1\\ 3 & 7 & 6\end{pmatrix}$$

$$(d)\begin{pmatrix}7 & -4 & -2\\ 4 & -1 & -2\\ 0 & 0 & 3\end{pmatrix}\qquad (e)\begin{pmatrix}4 & -1 & -1\\ 2 & -1 & -2\\ -3 & 7 & 6\end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XCVIII}}$

Indian Institute of Technology, Bhubaneswar

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M.Sc. Ist Semester 2015-16

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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\begin{pmatrix} 2 & -4 & -3 \\ -4 & 8 & 6 \\ 2 & -8 & -5 \end{pmatrix} \qquad (b)\begin{pmatrix} -2 & 4 & 0 \\ 0 & 2 & 0 \\ -4 & 4 & 2 \end{pmatrix} \qquad (c)\begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$$

$$(d)\begin{pmatrix} -1 & 2 & 2 \\ -1 & -4 & -1 \\ -1 & -1 & -4 \end{pmatrix} \qquad (e)\begin{pmatrix} 2 & 2 & 1 \\ 3 & 0 & -3 \\ -4 & 5 & 7 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: XCIX}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
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Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 2 & -4 & -2 \\ -1 & 1 & -2 \\ 0 & 2 & 3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 2 & 0 & 0 \\ 8 & -2 & -4 \\ -4 & 2 & 4 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -1 & 0 & 2 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & -3 & 6 \\ -1 & -1 & -2 \\ -2 & 2 & -6 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -1 & 1 & 2 \\ 2 & -2 & 5 \\ -2 & -1 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: C}}$

Indian Institute of Technology, Bhubaneswar

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M.Sc. Ist Semester 2015-16

A. K. Kapoor
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Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\begin{pmatrix} 2 & -4 & -1 \\ -5 & 1 & -5 \\ 4 & 4 & 7 \end{pmatrix} \qquad (b)\begin{pmatrix} 1 & -1 & 0 \\ 0 & 2 & 0 \\ -1 & -1 & 2 \end{pmatrix} \qquad (c)\begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d)\begin{pmatrix} -4 & 2 & -2 \\ 0 & -2 & 0 \\ 2 & -2 & 0 \end{pmatrix} \qquad (e)\begin{pmatrix} 0 & 2 & 4 \\ -1 & 0 & 1 \\ -2 & -2 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CI

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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 2 & -3 & 1 \\ -2 & 5 & -2 \\ -2 & 6 & -1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 6 & -4 & 1 \\ 3 & -1 & 1 \\ 0 & 0 & 3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 1 & 0 \\ -1 & -3 & 0 \\ 1 & 1 & -2 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -2 & 6 \\ -4 & -6 & 6 \\ -3 & -3 & 4 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CII}}$

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A. K. Kapoor

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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 2 & -2 & -2 \\ -3 & -3 & -6 \\ 7 & -1 & 2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 3 & -2 & -2 \\ 0 & 3 & 0 \\ 0 & -2 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & 1 \\ 4 & -5 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 2 & -2 \\ 0 & -2 & 1 \\ 0 & -1 & 0 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -6 & 4 & 4 \\ -2 & 0 & 2 \\ -1 & 0 & 0 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CIII}}$

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A. K. Kapoor

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Assignment -I $\boxed{\text{Mathematical Physics}}$ MM: 20

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 2 & -2 & 1 \\ -4 & 0 & -4 \\ 2 & 2 & 3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 5 & 0 & 2 \\ 2 & 3 & 2 \\ -4 & 0 & -1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 2 & 0 & 3 \\ 3 & -1 & 3 \\ 6 & -6 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -2 & 4 & -1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & 0 & -6 \\ 3 & -2 & -3 \\ 8 & -4 & -8 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CIV}}$

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M.Sc. Ist Semester 2015-16

A. K. Kapoor
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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 2 & 0 & -2 \\ -4 & -2 & 2 \\ 1 & 0 & 5 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & -1 & 0 \\ 2 & 4 & 0 \\ 4 & 2 & 3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -2 & -6 & 3 \\ 4 & 0 & 5 \\ 2 & 4 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -3 & 6 & -1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & -3 \\ -1 & 0 & 1 \\ 4 & -2 & -5 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CV}}$

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M.Sc. Ist Semester 2015-16

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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 2 & 2 & 2 \\ -6 & 2 & -2 \\ 6 & -2 & 2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -3 & 4 & 4 \\ 0 & -3 & 0 \\ 0 & 2 & -1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -4 & -8 & -7 \\ 1 & -3 & 1 \\ 3 & 7 & 6 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & -8 & 4 \\ 0 & -5 & 2 \\ 0 & -8 & 3 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 0 & 1 & 0 \\ -1 & 2 & 0 \\ 2 & -3 & 1 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CVI}}$

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 2 & 2 & 2 \\ -5 & -6 & -7 \\ 1 & 2 & 3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 0 & 0 & 3 \\ -2 & -2 & -3 \\ -2 & 0 & -5 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 3 & -4 & 0 \\ 1 & -1 & 0 \\ 2 & -4 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & 0 \\ -2 & 1 & -1 \\ 2 & 3 & 3 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CVII}}$

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M.Sc. Ist Semester 2015-16

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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 2 & 2 & 2 \\ 4 & 1 & 4 \\ 1 & -2 & 1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -7 & 5 & -5 \\ -5 & 3 & -5 \\ 5 & -5 & 3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -1 & 0 & 2 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 3 & 1 & -6 \\ 0 & 0 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -6 & -3 \\ 8 & 8 & 4 \\ 0 & 3 & 2 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CVIII}}$

Indian Institute of Technology, Bhubaneswar

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(Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 2 & 3 & 1 \\ -2 & -3 & -1 \\ -4 & -4 & -2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & 0 & -4 \\ 2 & -3 & -2 \\ 2 & 0 & -5 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 3 & -6 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & -1 & -1 \\ 2 & -1 & -2 \\ -3 & 7 & 6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CIX}}$

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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 2 & 3 & 1 \\ 3 & 4 & -3 \\ 7 & 9 & -4 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -5 & 0 & 4 \\ -2 & -1 & 2 \\ -2 & 0 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 2 & -8 & -4 \\ 0 & -2 & -2 \\ 0 & 8 & 6 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & 2 & 1 \\ 3 & 0 & -3 \\ -4 & 5 & 7 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CX}}$

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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 2 & 3 & 3 \\ -3 & 4 & 1 \\ 3 & -5 & -2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -6 & -2 & 4 \\ 6 & 1 & -6 \\ -2 & -1 & 0 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & 1 \\ 4 & -5 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 2 & 1 & 2 \\ 1 & 2 & -2 \\ -1 & 1 & 5 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -1 & 1 & 2 \\ 2 & -2 & 5 \\ -2 & -1 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CXI}}$

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$(a)\ \begin{pmatrix} 2 & 3 & 3 \\ -2 & -3 & -2 \\ -6 & -6 & 5 \end{pmatrix}$ $\quad (b)\ \begin{pmatrix} -4 & 6 & 0 \\ -1 & 1 & 0 \\ 0 & 0 & -1 \end{pmatrix}$ $\quad (c)\ \begin{pmatrix} 2 & 0 & 3 \\ 3 & -1 & 3 \\ 6 & -6 & 2 \end{pmatrix}$

$(d)\ \begin{pmatrix} 7 & -4 & -2 \\ 4 & -1 & -2 \\ 0 & 0 & 3 \end{pmatrix}$ $\quad (e)\ \begin{pmatrix} 0 & 2 & 4 \\ -1 & 0 & 1 \\ -2 & -2 & -6 \end{pmatrix}$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CXII}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 3 & -6 & 0 \\ -1 & 0 & -2 \\ -1 & 3 & 1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 7 & -8 & -4 \\ 0 & -1 & 0 \\ 8 & -8 & -5 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -2 & -6 & 3 \\ 4 & 0 & 5 \\ 2 & 4 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 2 & 2 \\ -1 & -4 & -1 \\ -1 & -1 & -4 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -2 & 6 \\ -4 & -6 & 6 \\ -3 & -3 & 4 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXIII

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 3 & -1 & 1 \\ 5 & -1 & 1 \\ 3 & -1 & 1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -2 & 1 & -3 \\ 1 & -2 & 3 \\ 1 & -1 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -4 & -8 & -7 \\ 1 & -3 & 1 \\ 3 & 7 & 6 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & -3 & 6 \\ -1 & -1 & -2 \\ -2 & 2 & -6 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -6 & 4 & 4 \\ -2 & 0 & 2 \\ -1 & 0 & 0 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXIV

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 3 & 0 & -6 \\ -1 & -1 & 1 \\ 1 & -2 & -4 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -1 & -2 & 6 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -4 & 2 & -2 \\ 0 & -2 & 0 \\ 2 & -2 & 0 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & 0 & -6 \\ 3 & -2 & -3 \\ 8 & -4 & -8 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CXV}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$(a)\ \begin{pmatrix} 3 & 0 & -3 \\ -6 & 6 & -6 \\ 2 & 0 & -2 \end{pmatrix}$ $\quad (b)\ \begin{pmatrix} -1 & 2 & 0 \\ -1 & 2 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ $\quad (c)\ \begin{pmatrix} -1 & 0 & 2 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix}$

$(d)\ \begin{pmatrix} -1 & 1 & 0 \\ -1 & -3 & 0 \\ 1 & 1 & -2 \end{pmatrix}$ $\quad (e)\ \begin{pmatrix} 2 & -1 & -3 \\ -1 & 0 & 1 \\ 4 & -2 & -5 \end{pmatrix}$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXVI

Indian Institute of Technology, Bhubaneswar

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 3 & 0 & 2 \\ 6 & -1 & 0 \\ -3 & 2 & 4 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -3 & -8 & 8 \\ 0 & 1 & -4 \\ 0 & 0 & -3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 2 & -2 \\ 0 & -2 & 1 \\ 0 & -1 & 0 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 0 & 1 & 0 \\ -1 & 2 & 0 \\ 2 & -3 & 1 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXVII

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 3 & 1 & 2 \\ -2 & 0 & -2 \\ -5 & -1 & -4 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & -6 & -3 \\ 0 & -1 & -1 \\ 0 & 2 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -2 & 4 & -1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & 0 \\ -2 & 1 & -1 \\ 2 & 3 & 3 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CXVIII}}$

Indian Institute of Technology, Bhubaneswar

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M.Sc. Ist Semester 2015-16

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Assignment -I | Mathematical Physics | MM: 20

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 3 & 2 & -2 \\ 6 & 6 & -6 \\ 6 & 4 & -4 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 2 & 2 & 0 \\ 0 & 1 & 0 \\ -2 & -4 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & 1 \\ 4 & -5 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -3 & 6 & -1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -6 & -3 \\ 8 & 8 & 4 \\ 0 & 3 & 2 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXIX

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
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Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 3 & 2 & 6 \\ -2 & 3 & -2 \\ -3 & -1 & -6 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -2 & 4 & 0 \\ 0 & 2 & 0 \\ -4 & 4 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 2 & 0 & 3 \\ 3 & -1 & 3 \\ 6 & -6 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & -8 & 4 \\ 0 & -5 & 2 \\ 0 & -8 & 3 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & -1 & -1 \\ 2 & -1 & -2 \\ -3 & 7 & 6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXX

Indian Institute of Technology, Bhubaneswar

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A. K. Kapoor

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Assignment -I | Mathematical Physics | MM: 20

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 3 & 3 & -5 \\ -2 & -2 & 5 \\ -4 & -4 & 5 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 2 & 0 & 0 \\ 8 & -2 & -4 \\ -4 & 2 & 4 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -2 & -6 & 3 \\ 4 & 0 & 5 \\ 2 & 4 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 3 & -4 & 0 \\ 1 & -1 & 0 \\ 2 & -4 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & 2 & 1 \\ 3 & 0 & -3 \\ -4 & 5 & 7 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXXI

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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 3 & 6 & 3 \\ -4 & -7 & -2 \\ -6 & -6 & 4 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & -1 & 0 \\ 0 & 2 & 0 \\ -1 & -1 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -4 & -8 & -7 \\ 1 & -3 & 1 \\ 3 & 7 & 6 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 3 & 1 & -6 \\ 0 & 0 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -1 & 1 & 2 \\ 2 & -2 & 5 \\ -2 & -1 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXXII

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences

Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor

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Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$(a) \begin{pmatrix} 4 & -7 & -7 \\ 4 & -7 & -7 \\ -4 & 4 & 4 \end{pmatrix}$ $(b) \begin{pmatrix} 6 & -4 & 1 \\ 3 & -1 & 1 \\ 0 & 0 & 3 \end{pmatrix}$ $(c) \begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$

$(d) \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 3 & -6 & 1 \end{pmatrix}$ $(e) \begin{pmatrix} 0 & 2 & 4 \\ -1 & 0 & 1 \\ -2 & -2 & -6 \end{pmatrix}$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

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M.Sc. Ist Semester 2015-16

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Assignment -I | Mathematical Physics | MM: 20

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 4 & -2 & 2 \\ -5 & 1 & -5 \\ 2 & 2 & 4 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 3 & -2 & -2 \\ 0 & 3 & 0 \\ 0 & -2 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -1 & 0 & 2 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 2 & -8 & -4 \\ 0 & -2 & -2 \\ 0 & 8 & 6 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -2 & 6 \\ -4 & -6 & 6 \\ -3 & -3 & 4 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXXIV

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M.Sc. Ist Semester 2015-16

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\begin{pmatrix} 4 & 0 & 2 \\ -4 & 0 & -2 \\ -1 & 0 & 1 \end{pmatrix} \qquad (b)\begin{pmatrix} 5 & 0 & 2 \\ 2 & 3 & 2 \\ -4 & 0 & -1 \end{pmatrix} \qquad (c)\begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d)\begin{pmatrix} 2 & 1 & 2 \\ 1 & 2 & -2 \\ -1 & 1 & 5 \end{pmatrix} \qquad (e)\begin{pmatrix} -6 & 4 & 4 \\ -2 & 0 & 2 \\ -1 & 0 & 0 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXXV

Indian Institute of Technology, Bhubaneswar

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M.Sc. Ist Semester 2015-16

A. K. Kapoor
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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 4 & 0 & 2 \\ -1 & -1 & 2 \\ -1 & 0 & 1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & -1 & 0 \\ 2 & 4 & 0 \\ 4 & 2 & 3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 7 & -4 & -2 \\ 4 & -1 & -2 \\ 0 & 0 & 3 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & 0 & -6 \\ 3 & -2 & -3 \\ 8 & -4 & -8 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

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$\boxed{\text{SetId: CXXVI}}$

Indian Institute of Technology, Bhubaneswar

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Assignment -I | Mathematical Physics | MM: 20

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 4 & 0 & 6 \\ -6 & -7 & 4 \\ -3 & 0 & -5 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -3 & 4 & 4 \\ 0 & -3 & 0 \\ 0 & 2 & -1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & 1 \\ 4 & -5 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 2 & 2 \\ -1 & -4 & -1 \\ -1 & -1 & -4 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & -3 \\ -1 & 0 & 1 \\ 4 & -2 & -5 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXXVII

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
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M.Sc. Ist Semester 2015-16

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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a) \begin{pmatrix} 4 & 0 & 6 \\ -2 & 2 & -7 \\ -2 & 0 & -3 \end{pmatrix} \qquad (b) \begin{pmatrix} 0 & 0 & 3 \\ -2 & -2 & -3 \\ -2 & 0 & -5 \end{pmatrix} \qquad (c) \begin{pmatrix} 2 & 0 & 3 \\ 3 & -1 & 3 \\ 6 & -6 & 2 \end{pmatrix}$$

$$(d) \begin{pmatrix} 1 & -3 & 6 \\ -1 & -1 & -2 \\ -2 & 2 & -6 \end{pmatrix} \qquad (e) \begin{pmatrix} 0 & 1 & 0 \\ -1 & 2 & 0 \\ 2 & -3 & 1 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

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$\boxed{\text{SetId: CXXVIII}}$

Indian Institute of Technology, Bhubaneswar

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 4 & 0 & 6 \\ 6 & 6 & -3 \\ -2 & 0 & -3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -7 & 5 & -5 \\ -5 & 3 & -5 \\ 5 & -5 & 3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -2 & -6 & 3 \\ 4 & 0 & 5 \\ 2 & 4 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -4 & 2 & -2 \\ 0 & -2 & 0 \\ 2 & -2 & 0 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & 0 \\ -2 & 1 & -1 \\ 2 & 3 & 3 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXXIX

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences

Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor

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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

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- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$(a)\ \begin{pmatrix} 4 & 0 & 6 \\ 8 & 7 & -2 \\ -2 & 0 & -3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & 0 & -4 \\ 2 & -3 & -2 \\ 2 & 0 & -5 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -4 & -8 & -7 \\ 1 & -3 & 1 \\ 3 & 7 & 6 \end{pmatrix}$

$(d)\ \begin{pmatrix} -1 & 1 & 0 \\ -1 & -3 & 0 \\ 1 & 1 & -2 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -6 & -3 \\ 8 & 8 & 4 \\ 0 & 3 & 2 \end{pmatrix}$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXXX

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- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\begin{pmatrix} 4 & 4 & 1 \\ -1 & -1 & -1 \\ -6 & -4 & -3 \end{pmatrix} \qquad (b)\begin{pmatrix} -5 & 0 & 4 \\ -2 & -1 & 2 \\ -2 & 0 & 1 \end{pmatrix} \qquad (c)\begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$$

$$(d)\begin{pmatrix} -1 & 2 & -2 \\ 0 & -2 & 1 \\ 0 & -1 & 0 \end{pmatrix} \qquad (e)\begin{pmatrix} 4 & -1 & -1 \\ 2 & -1 & -2 \\ -3 & 7 & 6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXXXI

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a) \begin{pmatrix} 4 & 5 & -3 \\ -1 & -2 & 3 \\ -1 & -1 & 2 \end{pmatrix} \qquad (b) \begin{pmatrix} -6 & -2 & 4 \\ 6 & 1 & -6 \\ -2 & -1 & 0 \end{pmatrix} \qquad (c) \begin{pmatrix} -1 & 0 & 2 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix}$$

$$(d) \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -2 & 4 & -1 \end{pmatrix} \qquad (e) \begin{pmatrix} 2 & 2 & 1 \\ 3 & 0 & -3 \\ -4 & 5 & 7 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CXXXII}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 5 & -8 & 2 \\ -1 & 0 & -2 \\ -2 & 4 & 0 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -4 & 6 & 0 \\ -1 & 1 & 0 \\ 0 & 0 & -1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -3 & 6 & -1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -1 & 1 & 2 \\ 2 & -2 & 5 \\ -2 & -1 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXXXIII

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences

Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor

email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 5 & -7 & -7 \\ 4 & -6 & -7 \\ -4 & 4 & 5 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 7 & -8 & -4 \\ 0 & -1 & 0 \\ 8 & -8 & -5 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & -8 & 4 \\ 0 & -5 & 2 \\ 0 & -8 & 3 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 0 & 2 & 4 \\ -1 & 0 & 1 \\ -2 & -2 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CXXXIV}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences

Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor

email:akkhcu@gmail.com

(Due on August 5, 2015)

Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$(a)\ \begin{pmatrix} 5 & -6 & -6 \\ 3 & -4 & -6 \\ -3 & 3 & 5 \end{pmatrix}$ $(b)\ \begin{pmatrix} -2 & 1 & -3 \\ 1 & -2 & 3 \\ 1 & -1 & 2 \end{pmatrix}$ $(c)\ \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & 1 \\ 4 & -5 & -1 \end{pmatrix}$

$(d)\ \begin{pmatrix} 3 & -4 & 0 \\ 1 & -1 & 0 \\ 2 & -4 & 1 \end{pmatrix}$ $(e)\ \begin{pmatrix} -4 & -2 & 6 \\ -4 & -6 & 6 \\ -3 & -3 & 4 \end{pmatrix}$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXXXV

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 5 & -3 & 3 \\ -1 & 3 & -3 \\ -3 & 3 & -3 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -1 & -2 & 6 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 2 & 0 & 3 \\ 3 & -1 & 3 \\ 6 & -6 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 3 & 1 & -6 \\ 0 & 0 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -6 & 4 & 4 \\ -2 & 0 & 2 \\ -1 & 0 & 0 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXXXVI

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences

Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor

email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 5 & 0 & -6 \\ -1 & 1 & 1 \\ 1 & -2 & -2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -1 & 2 & 0 \\ -1 & 2 & 0 \\ 0 & 0 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -2 & -6 & 3 \\ 4 & 0 & 5 \\ 2 & 4 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 3 & -6 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & 0 & -6 \\ 3 & -2 & -3 \\ 8 & -4 & -8 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CXXXVII}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 5 & 0 & 4 \\ -2 & 0 & -1 \\ -2 & 0 & -1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -3 & -8 & 8 \\ 0 & 1 & -4 \\ 0 & 0 & -3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -4 & -8 & -7 \\ 1 & -3 & 1 \\ 3 & 7 & 6 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 2 & -8 & -4 \\ 0 & -2 & -2 \\ 0 & 8 & 6 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & -3 \\ -1 & 0 & 1 \\ 4 & -2 & -5 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CXXXVIII}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com

(Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 5 & 0 & 6 \\ -6 & -7 & 6 \\ -3 & 0 & -4 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & -6 & -3 \\ 0 & -1 & -1 \\ 0 & 2 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 2 & 1 & 2 \\ 1 & 2 & -2 \\ -1 & 1 & 5 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 0 & 1 & 0 \\ -1 & 2 & 0 \\ 2 & -3 & 1 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CXXXIX}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 5 & 0 & 6 \\ -3 & -3 & -1 \\ -3 & 0 & -4 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 2 & 2 & 0 \\ 0 & 1 & 0 \\ -2 & -4 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -1 & 0 & 2 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 7 & -4 & -2 \\ 4 & -1 & -2 \\ 0 & 0 & 3 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & 0 \\ -2 & 1 & -1 \\ 2 & 3 & 3 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CXL}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences

Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor

email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 5 & 1 & 2 \\ -2 & 2 & -2 \\ -5 & -1 & -2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -2 & 4 & 0 \\ 0 & 2 & 0 \\ -4 & 4 & 2 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 2 & 2 \\ -1 & -4 & -1 \\ -1 & -1 & -4 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -4 & -6 & -3 \\ 8 & 8 & 4 \\ 0 & 3 & 2 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CXLI}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences

Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor

email:akkhcu@gmail.com

(Due on August 5, 2015)

Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 5 & 2 & -6 \\ -4 & -2 & 4 \\ 2 & 2 & 0 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 2 & 0 & 0 \\ 8 & -2 & -4 \\ -4 & 2 & 4 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & -3 & 6 \\ -1 & -1 & -2 \\ -2 & 2 & -6 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & -1 & -1 \\ 2 & -1 & -2 \\ -3 & 7 & 6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXLII

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a) \begin{pmatrix} 5 & 2 & 0 \\ -7 & -1 & 3 \\ 5 & 2 & 0 \end{pmatrix} \qquad (b) \begin{pmatrix} 1 & -1 & 0 \\ 0 & 2 & 0 \\ -1 & -1 & 2 \end{pmatrix} \qquad (c) \begin{pmatrix} 4 & -1 & -1 \\ -1 & 4 & 1 \\ 4 & -5 & -1 \end{pmatrix}$$

$$(d) \begin{pmatrix} -4 & 2 & -2 \\ 0 & -2 & 0 \\ 2 & -2 & 0 \end{pmatrix} \qquad (e) \begin{pmatrix} 2 & 2 & 1 \\ 3 & 0 & -3 \\ -4 & 5 & 7 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CXLIII}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 5 & 2 & 2 \\ -2 & 1 & 1 \\ -2 & -2 & -2 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 6 & -4 & 1 \\ 3 & -1 & 1 \\ 0 & 0 & 3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 2 & 0 & 3 \\ 3 & -1 & 3 \\ 6 & -6 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 1 & 0 \\ -1 & -3 & 0 \\ 1 & 1 & -2 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -1 & 1 & 2 \\ 2 & -2 & 5 \\ -2 & -1 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXLIV

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 6 & -7 & -1 \\ 4 & -4 & -2 \\ 2 & -3 & 1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 3 & -2 & -2 \\ 0 & 3 & 0 \\ 0 & -2 & 1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -2 & -6 & 3 \\ 4 & 0 & 5 \\ 2 & 4 & -1 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & 2 & -2 \\ 0 & -2 & 1 \\ 0 & -1 & 0 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 0 & 2 & 4 \\ -1 & 0 & 1 \\ -2 & -2 & -6 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CXLV}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com (Due on August 5, 2015)

Assignment -I | $\boxed{\text{Mathematical Physics}}$ | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$(a)\ \begin{pmatrix} 6 & 0 & -6 \\ 7 & -1 & -6 \\ 4 & 0 & -4 \end{pmatrix}$ $\quad (b)\ \begin{pmatrix} 5 & 0 & 2 \\ 2 & 3 & 2 \\ -4 & 0 & -1 \end{pmatrix}$ $\quad (c)\ \begin{pmatrix} -4 & -8 & -7 \\ 1 & -3 & 1 \\ 3 & 7 & 6 \end{pmatrix}$

$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -2 & 4 & -1 \end{pmatrix}$ $\quad (e)\ \begin{pmatrix} -4 & -2 & 6 \\ -4 & -6 & 6 \\ -3 & -3 & 4 \end{pmatrix}$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CXLVI}}$

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 6 & 0 & 1 \\ -3 & 1 & -3 \\ -6 & 0 & 1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 1 & -1 & 0 \\ 2 & 4 & 0 \\ 4 & 2 & 3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -3 & -2 & 3 \\ -2 & -3 & 3 \\ -4 & -8 & 7 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -3 & 4 & 0 \\ -1 & 1 & 0 \\ -3 & 6 & -1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} -6 & 4 & 4 \\ -2 & 0 & 2 \\ -1 & 0 & 0 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CXLVII}}$

Indian Institute of Technology, Bhubaneswar
School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
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Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 6 & 6 & 0 \\ -2 & -2 & -2 \\ 1 & 1 & 1 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -3 & 4 & 4 \\ 0 & -3 & 0 \\ 0 & 2 & -1 \end{pmatrix} \qquad (c)\ \begin{pmatrix} -1 & 0 & 2 \\ 0 & -3 & 6 \\ 0 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} -1 & -8 & 4 \\ 0 & -5 & 2 \\ 0 & -8 & 3 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 4 & 0 & -6 \\ 3 & -2 & -3 \\ 8 & -4 & -8 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXLVIII

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

M.Sc. Ist Semester 2015-16

A. K. Kapoor
email:akkhcu@gmail.com

(Due on August 5, 2015)

Assignment -I | Mathematical Physics | MM: 20

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 7 & -7 & -7 \\ 6 & -6 & -7 \\ -6 & 6 & 7 \end{pmatrix} \qquad (b)\ \begin{pmatrix} 0 & 0 & 3 \\ -2 & -2 & -3 \\ -2 & 0 & -5 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 1 & -1 & 0 \\ -1 & 1 & 1 \\ -1 & -1 & 2 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 3 & -4 & 0 \\ 1 & -1 & 0 \\ 2 & -4 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 2 & -1 & -3 \\ -1 & 0 & 1 \\ 4 & -2 & -5 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

SetId: CXLIX

Indian Institute of Technology, Bhubaneswar

School of Basic Sciences
Department of Physics

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Assignment -I | $\boxed{\text{Mathematical Physics}}$ | **MM: 20**

[1] Find eigenvalues and normalized eigenvectors of the following matrices and verify the following statements.

- The first matrix has three distinct eigenvalues.
- The second matrix has two distinct characteristic roots and three linearly independent eigenvectors.
- the third matrix has two different eigenvalues and only two linearly independent eigenvectors.
- All the three eigenvalues of the fourth matrix are equal and it has only two linearly independent eigenvectors.
- All the three eigenvalues of the fifth matrix are equal and it has only one linearly independent eigenvector.

$$(a)\ \begin{pmatrix} 7 & -6 & 6 \\ -1 & 2 & -4 \\ -5 & 5 & -7 \end{pmatrix} \qquad (b)\ \begin{pmatrix} -7 & 5 & -5 \\ -5 & 3 & -5 \\ 5 & -5 & 3 \end{pmatrix} \qquad (c)\ \begin{pmatrix} 3 & -1 & -1 \\ 0 & 2 & -1 \\ 1 & -1 & 3 \end{pmatrix}$$

$$(d)\ \begin{pmatrix} 1 & 0 & 0 \\ 3 & 1 & -6 \\ 0 & 0 & 1 \end{pmatrix} \qquad (e)\ \begin{pmatrix} 0 & 1 & 0 \\ -1 & 2 & 0 \\ 2 & -3 & 1 \end{pmatrix}$$

[2] Give an example of a 3×3 matrix which has three linearly independent eigenvectors and all three eigenvectors correspond to eigenvalue 1.

[3] Which of the above five matrices can be diagonalized? Give reasons to support your answer.

$\boxed{\text{SetId: CL}}$

[1] **Answers for Set No: I**

(a) The eigenvalues are $\{-2, 1, 0\}$ and the eigenvector(s) are

$$\{-2, \{3, -2, 1\}\} \quad \{1, \{1, -1, 1\}\} \quad \{0, \{-1, 1, 0\}\}$$

(b) The eigenvalues are $\{-3, -3, -1\}$ and the eigenvector(s) are

$$\{-3, \{0, -1, 1\}\} \quad \{-3, \{1, 0, 0\}\} \quad \{-1, \{2, 0, 1\}\}$$

(c) The eigenvalues are $\{-2, -2, 1\}$ and the eigenvector(s) are

$$\{-2, \{-3, 1, 2\}\} \quad \{1, \{-1, 1, 1\}\}$$

(d) The eigenvalues are $\{-3, -3, -3\}$ and the eigenvector(s) are

$$\{-3, \{-1, 0, 1\}\} \quad \{-3, \{-1, 1, 0\}\}$$

(e) The eigenvalues are $\{-3, -3, -3\}$ and the eigenvector(s) are

$$\{-3, \{-1, 2, 0\}\}$$

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[2] **Answers for Set No: II**

(a) The eigenvalues are $\{6, 1, 0\}$ and the eigenvector(s) are

$$\{6, \{1, -1, 1\}\} \quad \{1, \{-1, 2, 1\}\} \quad \{0, \{-1, 1, 0\}\}$$

(b) The eigenvalues are $\{-3, -2, -2\}$ and the eigenvector(s) are

$$\{-3, \{-1, 1, 1\}\} \quad \{-2, \{-3, 0, 2\}\} \quad \{-2, \{0, 1, 0\}\}$$

(c) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{-2, \{-3, -1, 2\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-2, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, -1, 1\}\}$$

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[3] **Answers for Set No: III**

(a) The eigenvalues are $\{3, 2, 1\}$ and the eigenvector(s) are

$$\{3, \{-3, 2, 2\}\} \quad \{2, \{-1, 0, 1\}\} \quad \{1, \{-3, 1, 2\}\}$$

(b) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{-2, \{-1, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(c) The eigenvalues are $\{-1, 1, 1\}$ and the eigenvector(s) are

$$\{-1, \{2, 1, 2\}\} \quad \{1, \{1, 1, 2\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, 1, 0\}\}$$

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[4] **Answers for Set No: IV**

(a) The eigenvalues are $\{-5, -3, 0\}$ and the eigenvector(s) are

$$\{-5, \{-5, -3, 4\}\} \quad \{-3, \{-2, -1, 2\}\} \quad \{0, \{-1, 0, 1\}\}$$

(b) The eigenvalues are $\{-3, -3, -1\}$ and the eigenvector(s) are

$$\{-3, \{1, 0, 1\}\} \quad \{-3, \{0, 1, 0\}\} \quad \{-1, \{2, 1, 1\}\}$$

(c) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 0\}\} \quad \{0, \{2, 2, 1\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{0, 0, 1\}\} \quad \{-2, \{-1, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{2, 1, 1\}\}$$

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[5] **Answers for Set No: V**

(a) The eigenvalues are $\{4, -1, 0\}$ and the eigenvector(s) are

$$\{4, \{1, -1, 1\}\} \quad \{-1, \{-1, 1, 0\}\} \quad \{0, \{-1, 2, 1\}\}$$

(b) The eigenvalues are $\{-3, -1, -1\}$ and the eigenvector(s) are

$$\{-3, \{2, 1, 1\}\} \quad \{-1, \{1, 0, 1\}\} \quad \{-1, \{0, 1, 0\}\}$$

(c) The eigenvalues are $\{2, 1, 1\}$ and the eigenvector(s) are

$$\{2, \{-1, 1, 0\}\} \quad \{1, \{1, 0, 1\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 1, 1\}\} \quad \{-1, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{2, 1, 2\}\}$$

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[6] **Answers for Set No: VI**

(a) The eigenvalues are $\{-4, 1, 0\}$ and the eigenvector(s) are

$$\{-4, \{-1, 1, 0\}\} \quad \{1, \{-1, 1, 1\}\} \quad \{0, \{-2, 3, 1\}\}$$

(b) The eigenvalues are $\{-2, -2, -1\}$ and the eigenvector(s) are

$$\{-2, \{1, 0, 1\}\} \quad \{-2, \{-1, 2, 0\}\} \quad \{-1, \{2, -3, 1\}\}$$

(c) The eigenvalues are $\{3, 3, 2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{2, \{1, 1, 0\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 1\}\}$$

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[7] **Answers for Set No: VII**

(a) The eigenvalues are $\{7,2,1\}$ and the eigenvector(s) are

$$\{7,\{1,-1,1\}\} \quad \{2,\{-1,1,0\}\} \quad \{1,\{3,-2,1\}\}$$

(b) The eigenvalues are $\{-2,-1,-1\}$ and the eigenvector(s) are

$$\{-2,\{3,1,0\}\} \quad \{-1,\{0,0,1\}\} \quad \{-1,\{2,1,0\}\}$$

(c) The eigenvalues are $\{3,2,2\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\} \quad \{2,\{1,-1,3\}\}$$

(d) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{0,0,1\}\} \quad \{-1,\{2,1,0\}\}$$

(e) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\}$$

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[8] **Answers for Set No: VIII**

(a) The eigenvalues are $\{3,-1,0\}$ and the eigenvector(s) are

$$\{3,\{1,-1,1\}\} \quad \{-1,\{3,-2,1\}\} \quad \{0,\{-1,1,0\}\}$$

(b) The eigenvalues are $\{3,-1,-1\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\} \quad \{-1,\{1,0,2\}\} \quad \{-1,\{1,1,0\}\}$$

(c) The eigenvalues are $\{2,2,-1\}$ and the eigenvector(s) are

$$\{2,\{1,1,0\}\} \quad \{-1,\{-2,-1,2\}\}$$

(d) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{0,1,2\}\} \quad \{-1,\{1,0,0\}\}$$

(e) The eigenvalues are $\{2,2,2\}$ and the eigenvector(s) are

$$\{2,\{-1,0,2\}\}$$

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[9] **Answers for Set No: IX**

(a) The eigenvalues are $\{3, -1, 0\}$ and the eigenvector(s) are

$$\{3, \{1, -1, 1\}\} \quad \{-1, \{-1, 1, 0\}\} \quad \{0, \{-1, 2, 1\}\}$$

(b) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{-3, 0, 1\}\} \quad \{-1, \{1, 1, 0\}\} \quad \{0, \{-1, 1, 1\}\}$$

(c) The eigenvalues are $\{-2, -2, 1\}$ and the eigenvector(s) are

$$\{-2, \{-3, 1, 2\}\} \quad \{1, \{-1, 1, 1\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\} \quad \{1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[10] **Answers for Set No: X**

(a) The eigenvalues are $\{-4, -3, 0\}$ and the eigenvector(s) are

$$\{-4, \{-1, 0, 1\}\} \quad \{-3, \{-2, 1, 3\}\} \quad \{0, \{0, 1, 0\}\}$$

(b) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{0, 3, 1\}\} \quad \{-1, \{1, 0, 0\}\} \quad \{0, \{2, 2, 1\}\}$$

(c) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{-2, \{-3, -1, 2\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{2, 0, 1\}\} \quad \{1, \{0, 1, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[11] **Answers for Set No: XI**

(a) The eigenvalues are $\{2, -1, 0\}$ and the eigenvector(s) are

$$\{2, \{-2, -2, 1\}\} \quad \{-1, \{1, 1, 0\}\} \quad \{0, \{-7, -6, 2\}\}$$

(b) The eigenvalues are $\{1, 1, 0\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\} \quad \{1, \{1, 1, 0\}\} \quad \{0, \{2, 1, 0\}\}$$

(c) The eigenvalues are $\{-1, 1, 1\}$ and the eigenvector(s) are

$$\{-1, \{2, 1, 2\}\} \quad \{1, \{1, 1, 2\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\} \quad \{1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[12] **Answers for Set No: XII**

(a) The eigenvalues are $\{5, 1, 0\}$ and the eigenvector(s) are

$$\{5, \{-2, -2, 1\}\} \quad \{1, \{-2, -1, 1\}\} \quad \{0, \{-1, 0, 1\}\}$$

(b) The eigenvalues are $\{-3, -3, 1\}$ and the eigenvector(s) are

$$\{-3, \{0, 1, 1\}\} \quad \{-3, \{1, 0, 0\}\} \quad \{1, \{-2, 1, 0\}\}$$

(c) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 0\}\} \quad \{0, \{2, 2, 1\}\}$$

(d) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{0, -1, 2\}\} \quad \{2, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{-3, -3, -3\}$ and the eigenvector(s) are

$$\{-3, \{-1, 2, 0\}\}$$

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[13] **Answers for Set No: XIII**

(a) The eigenvalues are $\{4, -3, 2\}$ and the eigenvector(s) are

$$\{4, \{-1, 1, 0\}\} \quad \{-3, \{1, 0, 1\}\} \quad \{2, \{-1, 1, 1\}\}$$

(b) The eigenvalues are $\{1, 1, 0\}$ and the eigenvector(s) are

$$\{1, \{0, -1, 2\}\} \quad \{1, \{1, 0, 0\}\} \quad \{0, \{-3, -1, 1\}\}$$

(c) The eigenvalues are $\{2, 1, 1\}$ and the eigenvector(s) are

$$\{2, \{-1, 1, 0\}\} \quad \{1, \{1, 0, 1\}\}$$

(d) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{2, 0, 1\}\} \quad \{3, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, -1, 1\}\}$$

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[14] **Answers for Set No: XIV**

(a) The eigenvalues are $\{3, 2, 0\}$ and the eigenvector(s) are

$$\{3, \{1, -1, 1\}\} \quad \{2, \{-1, 1, 0\}\} \quad \{0, \{3, -2, 1\}\}$$

(b) The eigenvalues are $\{2, 1, 1\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\} \quad \{1, \{0, 0, 1\}\} \quad \{1, \{-2, 1, 0\}\}$$

(c) The eigenvalues are $\{3, 3, 2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{2, \{1, 1, 0\}\}$$

(d) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 2\}\} \quad \{3, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, 1, 0\}\}$$

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[15] **Answers for Set No: XV**

(a) The eigenvalues are $\{-5,-3,1\}$ and the eigenvector(s) are

$$\{-5,\{-1,0,1\}\} \quad \{-3,\{-3,1,3\}\} \quad \{1,\{-1,1,2\}\}$$

(b) The eigenvalues are $\{-2,2,2\}$ and the eigenvector(s) are

$$\{-2,\{1,0,1\}\} \quad \{2,\{0,0,1\}\} \quad \{2,\{1,1,0\}\}$$

(c) The eigenvalues are $\{3,2,2\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\} \quad \{2,\{1,-1,3\}\}$$

(d) The eigenvalues are $\{-3,-3,-3\}$ and the eigenvector(s) are

$$\{-3,\{-1,0,1\}\} \quad \{-3,\{-1,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{2,1,1\}\}$$

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[16] **Answers for Set No: XVI**

(a) The eigenvalues are $\{-2,-1,0\}$ and the eigenvector(s) are

$$\{-2,\{-1,1,0\}\} \quad \{-1,\{3,-2,2\}\} \quad \{0,\{3,-2,3\}\}$$

(b) The eigenvalues are $\{2,2,0\}$ and the eigenvector(s) are

$$\{2,\{1,0,2\}\} \quad \{2,\{1,2,0\}\} \quad \{0,\{0,-2,1\}\}$$

(c) The eigenvalues are $\{2,2,-1\}$ and the eigenvector(s) are

$$\{2,\{1,1,0\}\} \quad \{-1,\{-2,-1,2\}\}$$

(d) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-2,0,1\}\} \quad \{-2,\{1,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{2,1,2\}\}$$

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[17] **Answers for Set No: XVII**

(a) The eigenvalues are $\{-3,-2,1\}$ and the eigenvector(s) are

$$\{-3,\{-1,0,1\}\} \quad \{-2,\{-2,1,3\}\} \quad \{1,\{0,1,0\}\}$$

(b) The eigenvalues are $\{2,2,1\}$ and the eigenvector(s) are

$$\{2,\{0,0,1\}\} \quad \{2,\{-1,1,0\}\} \quad \{1,\{1,0,1\}\}$$

(c) The eigenvalues are $\{-2,-2,1\}$ and the eigenvector(s) are

$$\{-2,\{-3,1,2\}\} \quad \{1,\{-1,1,1\}\}$$

(d) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-1,0,1\}\} \quad \{-2,\{1,1,0\}\}$$

(e) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{1,0,1\}\}$$

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[18] **Answers for Set No: XVIII**

(a) The eigenvalues are $\{5,1,0\}$ and the eigenvector(s) are

$$\{5,\{1,1,1\}\} \quad \{1,\{0,-1,1\}\} \quad \{0,\{1,-1,2\}\}$$

(b) The eigenvalues are $\{3,3,2\}$ and the eigenvector(s) are

$$\{3,\{-1,0,3\}\} \quad \{3,\{4,3,0\}\} \quad \{2,\{1,1,0\}\}$$

(c) The eigenvalues are $\{3,-2,-2\}$ and the eigenvector(s) are

$$\{3,\{-1,0,1\}\} \quad \{-2,\{-3,-1,2\}\}$$

(d) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{0,0,1\}\} \quad \{-2,\{-1,1,0\}\}$$

(e) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\}$$

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[19] **Answers for Set No: XIX**

(a) The eigenvalues are $\{3, -1, 0\}$ and the eigenvector(s) are

$$\{3, \{-2, -2, 1\}\} \quad \{-1, \{-1, 0, 1\}\} \quad \{0, \{-2, -1, 1\}\}$$

(b) The eigenvalues are $\{3, 3, 1\}$ and the eigenvector(s) are

$$\{3, \{0, -1, 1\}\} \quad \{3, \{1, 0, 0\}\} \quad \{1, \{1, 0, 1\}\}$$

(c) The eigenvalues are $\{-1, 1, 1\}$ and the eigenvector(s) are

$$\{-1, \{2, 1, 2\}\} \quad \{1, \{1, 1, 2\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 1, 1\}\} \quad \{-1, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[20] **Answers for Set No: XX**

(a) The eigenvalues are $\{5, 2, 1\}$ and the eigenvector(s) are

$$\{5, \{1, -1, 1\}\} \quad \{2, \{-1, 1, 0\}\} \quad \{1, \{3, -2, 1\}\}$$

(b) The eigenvalues are $\{3, 3, 1\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{3, \{0, 1, 0\}\} \quad \{1, \{-1, -1, 2\}\}$$

(c) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 0\}\} \quad \{0, \{2, 2, 1\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[21] **Answers for Set No: XXI**

(a) The eigenvalues are $\{3, -2, 1\}$ and the eigenvector(s) are

$$\{3, \{-1, 2, 1\}\} \quad \{-2, \{-1, 1, 1\}\} \quad \{1, \{-1, 1, 0\}\}$$

(b) The eigenvalues are $\{3, 3, 2\}$ and the eigenvector(s) are

$$\{3, \{0, 0, 1\}\} \quad \{3, \{-1, 2, 0\}\} \quad \{2, \{-1, 1, 2\}\}$$

(c) The eigenvalues are $\{2, 1, 1\}$ and the eigenvector(s) are

$$\{2, \{-1, 1, 0\}\} \quad \{1, \{1, 0, 1\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[22] **Answers for Set No: XXII**

(a) The eigenvalues are $\{3, 2, 0\}$ and the eigenvector(s) are

$$\{3, \{-2, 3, 1\}\} \quad \{2, \{-1, 1, 1\}\} \quad \{0, \{-1, 1, 0\}\}$$

(b) The eigenvalues are $\{-3, -3, -1\}$ and the eigenvector(s) are

$$\{-3, \{0, -1, 1\}\} \quad \{-3, \{1, 0, 0\}\} \quad \{-1, \{2, 0, 1\}\}$$

(c) The eigenvalues are $\{3, 3, 2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{2, \{1, 1, 0\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 1, 2\}\} \quad \{-1, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[23] **Answers for Set No: XXIII**

(a) The eigenvalues are $\{-3,-1,0\}$ and the eigenvector(s) are

$$\{-3,\{1,0,1\}\} \quad \{-1,\{5,-3,3\}\} \quad \{0,\{-1,1,0\}\}$$

(b) The eigenvalues are $\{-3,-2,-2\}$ and the eigenvector(s) are

$$\{-3,\{-1,1,1\}\} \quad \{-2,\{-3,0,2\}\} \quad \{-2,\{0,1,0\}\}$$

(c) The eigenvalues are $\{3,2,2\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\} \quad \{2,\{1,-1,3\}\}$$

(d) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\} \quad \{1,\{2,1,0\}\}$$

(e) The eigenvalues are $\{-3,-3,-3\}$ and the eigenvector(s) are

$$\{-3,\{-1,2,0\}\}$$

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[24] **Answers for Set No: XXIV**

(a) The eigenvalues are $\{-5,-1,0\}$ and the eigenvector(s) are

$$\{-5,\{-1,1,1\}\} \quad \{-1,\{-1,2,1\}\} \quad \{0,\{-1,1,0\}\}$$

(b) The eigenvalues are $\{3,-2,-2\}$ and the eigenvector(s) are

$$\{3,\{-1,-1,1\}\} \quad \{-2,\{-1,0,1\}\} \quad \{-2,\{1,1,0\}\}$$

(c) The eigenvalues are $\{2,2,-1\}$ and the eigenvector(s) are

$$\{2,\{1,1,0\}\} \quad \{-1,\{-2,-1,2\}\}$$

(d) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{2,0,1\}\} \quad \{1,\{0,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-1,-1,1\}\}$$

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[25] **Answers for Set No: XXV**

(a) The eigenvalues are $\{-3,1,0\}$ and the eigenvector(s) are

$$\{-3,\{-1,0,1\}\} \quad \{1,\{-1,1,2\}\} \quad \{0,\{-3,2,6\}\}$$

(b) The eigenvalues are $\{-3,-3,-1\}$ and the eigenvector(s) are

$$\{-3,\{1,0,1\}\} \quad \{-3,\{0,1,0\}\} \quad \{-1,\{2,1,1\}\}$$

(c) The eigenvalues are $\{-2,-2,1\}$ and the eigenvector(s) are

$$\{-2,\{-3,1,2\}\} \quad \{1,\{-1,1,1\}\}$$

(d) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\} \quad \{1,\{2,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-1,1,0\}\}$$

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[26] **Answers for Set No: XXVI**

(a) The eigenvalues are $\{-2,1,0\}$ and the eigenvector(s) are

$$\{-2,\{-1,1,0\}\} \quad \{1,\{-1,0,1\}\} \quad \{0,\{-2,-1,2\}\}$$

(b) The eigenvalues are $\{-3,-1,-1\}$ and the eigenvector(s) are

$$\{-3,\{2,1,1\}\} \quad \{-1,\{1,0,1\}\} \quad \{-1,\{0,1,0\}\}$$

(c) The eigenvalues are $\{3,-2,-2\}$ and the eigenvector(s) are

$$\{3,\{-1,0,1\}\} \quad \{-2,\{-3,-1,2\}\}$$

(d) The eigenvalues are $\{2,2,2\}$ and the eigenvector(s) are

$$\{2,\{0,-1,2\}\} \quad \{2,\{1,0,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{2,1,1\}\}$$

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[27] **Answers for Set No: XXVII**

(a) The eigenvalues are $\{-3,-1,0\}$ and the eigenvector(s) are

$$\{-3,\{-1,1,0\}\} \quad \{-1,\{-2,3,1\}\} \quad \{0,\{-1,1,1\}\}$$

(b) The eigenvalues are $\{-2,-2,-1\}$ and the eigenvector(s) are

$$\{-2,\{1,0,1\}\} \quad \{-2,\{-1,2,0\}\} \quad \{-1,\{2,-3,1\}\}$$

(c) The eigenvalues are $\{-1,1,1\}$ and the eigenvector(s) are

$$\{-1,\{2,1,2\}\} \quad \{1,\{1,1,2\}\}$$

(d) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{2,0,1\}\} \quad \{3,\{1,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{2,1,2\}\}$$

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[28] **Answers for Set No: XXVIII**

(a) The eigenvalues are $\{-3,-1,0\}$ and the eigenvector(s) are

$$\{-3,\{1,1,1\}\} \quad \{-1,\{1,1,2\}\} \quad \{0,\{1,2,3\}\}$$

(b) The eigenvalues are $\{-2,-1,-1\}$ and the eigenvector(s) are

$$\{-2,\{3,1,0\}\} \quad \{-1,\{0,0,1\}\} \quad \{-1,\{2,1,0\}\}$$

(c) The eigenvalues are $\{-1,-1,0\}$ and the eigenvector(s) are

$$\{-1,\{1,0,0\}\} \quad \{0,\{2,2,1\}\}$$

(d) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{1,0,2\}\} \quad \{3,\{1,1,0\}\}$$

(e) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{1,0,1\}\}$$

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[29] **Answers for Set No: XXIX**

(a) The eigenvalues are $\{-2,-1,0\}$ and the eigenvector(s) are

$$\{-2,\{-3,3,1\}\} \quad \{-1,\{-2,2,1\}\} \quad \{0,\{0,1,0\}\}$$

(b) The eigenvalues are $\{3,-1,-1\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\} \quad \{-1,\{1,0,2\}\} \quad \{-1,\{1,1,0\}\}$$

(c) The eigenvalues are $\{2,1,1\}$ and the eigenvector(s) are

$$\{2,\{-1,1,0\}\} \quad \{1,\{1,0,1\}\}$$

(d) The eigenvalues are $\{-3,-3,-3\}$ and the eigenvector(s) are

$$\{-3,\{-1,0,1\}\} \quad \{-3,\{-1,1,0\}\}$$

(e) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\}$$

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[30] **Answers for Set No: XXX**

(a) The eigenvalues are $\{-4,-2,0\}$ and the eigenvector(s) are

$$\{-4,\{-1,-1,1\}\} \quad \{-2,\{1,1,0\}\} \quad \{0,\{0,-1,1\}\}$$

(b) The eigenvalues are $\{-1,-1,0\}$ and the eigenvector(s) are

$$\{-1,\{-3,0,1\}\} \quad \{-1,\{1,1,0\}\} \quad \{0,\{-1,1,1\}\}$$

(c) The eigenvalues are $\{3,3,2\}$ and the eigenvector(s) are

$$\{3,\{-1,-1,1\}\} \quad \{2,\{1,1,0\}\}$$

(d) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-2,0,1\}\} \quad \{-2,\{1,1,0\}\}$$

(e) The eigenvalues are $\{2,2,2\}$ and the eigenvector(s) are

$$\{2,\{-1,0,2\}\}$$

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[31] **Answers for Set No: XXXI**

(a) The eigenvalues are $\{-4,3,0\}$ and the eigenvector(s) are

$$\{-4,\{-1,-1,1\}\} \quad \{3,\{0,-1,1\}\} \quad \{0,\{1,1,0\}\}$$

(b) The eigenvalues are $\{-1,-1,0\}$ and the eigenvector(s) are

$$\{-1,\{0,3,1\}\} \quad \{-1,\{1,0,0\}\} \quad \{0,\{2,2,1\}\}$$

(c) The eigenvalues are $\{3,2,2\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\} \quad \{2,\{1,-1,3\}\}$$

(d) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-1,0,1\}\} \quad \{-2,\{1,1,0\}\}$$

(e) The eigenvalues are $\{2,2,2\}$ and the eigenvector(s) are

$$\{2,\{-1,0,2\}\}$$

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[32] **Answers for Set No: XXXII**

(a) The eigenvalues are $\{-4,1,0\}$ and the eigenvector(s) are

$$\{-4,\{-1,-1,1\}\} \quad \{1,\{0,-1,1\}\} \quad \{0,\{1,1,0\}\}$$

(b) The eigenvalues are $\{1,1,0\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\} \quad \{1,\{1,1,0\}\} \quad \{0,\{2,1,0\}\}$$

(c) The eigenvalues are $\{2,2,-1\}$ and the eigenvector(s) are

$$\{2,\{1,1,0\}\} \quad \{-1,\{-2,-1,2\}\}$$

(d) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{0,0,1\}\} \quad \{-2,\{-1,1,0\}\}$$

(e) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\}$$

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[33] **Answers for Set No: XXXIII**

(a) The eigenvalues are $\{2, -1, 0\}$ and the eigenvector(s) are

$$\{2, \{1, 1, 0\}\} \quad \{-1, \{0, -1, 1\}\} \quad \{0, \{-3, -4, 2\}\}$$

(b) The eigenvalues are $\{-3, -3, 1\}$ and the eigenvector(s) are

$$\{-3, \{0, 1, 1\}\} \quad \{-3, \{1, 0, 0\}\} \quad \{1, \{-2, 1, 0\}\}$$

(c) The eigenvalues are $\{-2, -2, 1\}$ and the eigenvector(s) are

$$\{-2, \{-3, 1, 2\}\} \quad \{1, \{-1, 1, 1\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 1, 1\}\} \quad \{-1, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[34] **Answers for Set No: XXXIV**

(a) The eigenvalues are $\{-3, 2, 0\}$ and the eigenvector(s) are

$$\{-3, \{0, -1, 1\}\} \quad \{2, \{1, 1, 0\}\} \quad \{0, \{-3, -4, 2\}\}$$

(b) The eigenvalues are $\{1, 1, 0\}$ and the eigenvector(s) are

$$\{1, \{0, -1, 2\}\} \quad \{1, \{1, 0, 0\}\} \quad \{0, \{-3, -1, 1\}\}$$

(c) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{-2, \{-3, -1, 2\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{-3, -3, -3\}$ and the eigenvector(s) are

$$\{-3, \{-1, 2, 0\}\}$$

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[35] **Answers for Set No: XXXV**

(a) The eigenvalues are $\{4, 3, -2\}$ and the eigenvector(s) are

$$\{4, \{-1, 1, 0\}\} \quad \{3, \{-1, 1, 1\}\} \quad \{-2, \{1, 0, 1\}\}$$

(b) The eigenvalues are $\{2, 1, 1\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\} \quad \{1, \{0, 0, 1\}\} \quad \{1, \{-2, 1, 0\}\}$$

(c) The eigenvalues are $\{-1, 1, 1\}$ and the eigenvector(s) are

$$\{-1, \{2, 1, 2\}\} \quad \{1, \{1, 1, 2\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, -1, 1\}\}$$

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[36] **Answers for Set No: XXXVI**

(a) The eigenvalues are $\{3, -2, 1\}$ and the eigenvector(s) are

$$\{3, \{-1, 1, 0\}\} \quad \{-2, \{-2, -1, 2\}\} \quad \{1, \{-1, 0, 1\}\}$$

(b) The eigenvalues are $\{-2, 2, 2\}$ and the eigenvector(s) are

$$\{-2, \{1, 0, 1\}\} \quad \{2, \{0, 0, 1\}\} \quad \{2, \{1, 1, 0\}\}$$

(c) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 0\}\} \quad \{0, \{2, 2, 1\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 1, 2\}\} \quad \{-1, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, 1, 0\}\}$$

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[37] **Answers for Set No: XXXVII**

(a) The eigenvalues are $\{7, 2, 1\}$ and the eigenvector(s) are

$$\{7, \{-1, 1, 1\}\} \quad \{2, \{-2, 1, 1\}\} \quad \{1, \{-1, 1, 0\}\}$$

(b) The eigenvalues are $\{2, 2, 0\}$ and the eigenvector(s) are

$$\{2, \{1, 0, 2\}\} \quad \{2, \{1, 2, 0\}\} \quad \{0, \{0, -2, 1\}\}$$

(c) The eigenvalues are $\{2, 1, 1\}$ and the eigenvector(s) are

$$\{2, \{-1, 1, 0\}\} \quad \{1, \{1, 0, 1\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\} \quad \{1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{2, 1, 1\}\}$$

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[38] **Answers for Set No: XXXVIII**

(a) The eigenvalues are $\{2, 1, 0\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 1\}\} \quad \{1, \{-1, 1, 0\}\} \quad \{0, \{-2, -1, 2\}\}$$

(b) The eigenvalues are $\{2, 2, 1\}$ and the eigenvector(s) are

$$\{2, \{0, 0, 1\}\} \quad \{2, \{-1, 1, 0\}\} \quad \{1, \{1, 0, 1\}\}$$

(c) The eigenvalues are $\{3, 3, 2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{2, \{1, 1, 0\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{2, 0, 1\}\} \quad \{1, \{0, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{2, 1, 2\}\}$$

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[39] **Answers for Set No: XXXIX**

(a) The eigenvalues are $\{5,1,0\}$ and the eigenvector(s) are

$$\{5,\{-1,1,1\}\} \quad \{1,\{-2,1,1\}\} \quad \{0,\{-1,1,0\}\}$$

(b) The eigenvalues are $\{3,3,2\}$ and the eigenvector(s) are

$$\{3,\{-1,0,3\}\} \quad \{3,\{4,3,0\}\} \quad \{2,\{1,1,0\}\}$$

(c) The eigenvalues are $\{3,2,2\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\} \quad \{2,\{1,-1,3\}\}$$

(d) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\} \quad \{1,\{2,1,0\}\}$$

(e) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{1,0,1\}\}$$

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[40] **Answers for Set No: XL**

(a) The eigenvalues are $\{3,2,0\}$ and the eigenvector(s) are

$$\{3,\{-1,2,3\}\} \quad \{2,\{-3,5,6\}\} \quad \{0,\{-1,1,1\}\}$$

(b) The eigenvalues are $\{3,3,1\}$ and the eigenvector(s) are

$$\{3,\{0,-1,1\}\} \quad \{3,\{1,0,0\}\} \quad \{1,\{1,0,1\}\}$$

(c) The eigenvalues are $\{2,2,-1\}$ and the eigenvector(s) are

$$\{2,\{1,1,0\}\} \quad \{-1,\{-2,-1,2\}\}$$

(d) The eigenvalues are $\{2,2,2\}$ and the eigenvector(s) are

$$\{2,\{0,-1,2\}\} \quad \{2,\{1,0,0\}\}$$

(e) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\}$$

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[41] **Answers for Set No: XLI**

(a) The eigenvalues are $\{5, -2, 1\}$ and the eigenvector(s) are

$$\{5, \{-1, 1, 1\}\} \quad \{-2, \{0, 1, 0\}\} \quad \{1, \{-2, 2, 1\}\}$$

(b) The eigenvalues are $\{3, 3, 1\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{3, \{0, 1, 0\}\} \quad \{1, \{-1, -1, 2\}\}$$

(c) The eigenvalues are $\{-2, -2, 1\}$ and the eigenvector(s) are

$$\{-2, \{-3, 1, 2\}\} \quad \{1, \{-1, 1, 1\}\}$$

(d) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{2, 0, 1\}\} \quad \{3, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[42] **Answers for Set No: XLII**

(a) The eigenvalues are $\{-2, -1, 0\}$ and the eigenvector(s) are

$$\{-2, \{1, -1, 2\}\} \quad \{-1, \{1, 1, 1\}\} \quad \{0, \{0, -1, 1\}\}$$

(b) The eigenvalues are $\{3, 3, 2\}$ and the eigenvector(s) are

$$\{3, \{0, 0, 1\}\} \quad \{3, \{-1, 2, 0\}\} \quad \{2, \{-1, 1, 2\}\}$$

(c) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{-2, \{-3, -1, 2\}\}$$

(d) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 2\}\} \quad \{3, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[43] **Answers for Set No: XLIII**

(a) The eigenvalues are $\{-5, -3, 2\}$ and the eigenvector(s) are

$$\{-5, \{0, -1, 1\}\} \quad \{-3, \{-1, -3, 3\}\} \quad \{2, \{1, 1, 0\}\}$$

(b) The eigenvalues are $\{-3, -3, -1\}$ and the eigenvector(s) are

$$\{-3, \{0, -1, 1\}\} \quad \{-3, \{1, 0, 0\}\} \quad \{-1, \{2, 0, 1\}\}$$

(c) The eigenvalues are $\{-1, 1, 1\}$ and the eigenvector(s) are

$$\{-1, \{2, 1, 2\}\} \quad \{1, \{1, 1, 2\}\}$$

(d) The eigenvalues are $\{-3, -3, -3\}$ and the eigenvector(s) are

$$\{-3, \{-1, 0, 1\}\} \quad \{-3, \{-1, 1, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[44] **Answers for Set No: XLIV**

(a) The eigenvalues are $\{4, 2, -1\}$ and the eigenvector(s) are

$$\{4, \{-2, -2, 1\}\} \quad \{2, \{-2, -1, 2\}\} \quad \{-1, \{-1, 0, 1\}\}$$

(b) The eigenvalues are $\{-3, -2, -2\}$ and the eigenvector(s) are

$$\{-3, \{-1, 1, 1\}\} \quad \{-2, \{-3, 0, 2\}\} \quad \{-2, \{0, 1, 0\}\}$$

(c) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 0\}\} \quad \{0, \{2, 2, 1\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-2, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[45] **Answers for Set No: XLV**

(a) The eigenvalues are $\{3, 2, -1\}$ and the eigenvector(s) are

$$\{3, \{-1, 1, 0\}\} \quad \{2, \{-1, 1, 1\}\} \quad \{-1, \{1, 0, 1\}\}$$

(b) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{-2, \{-1, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(c) The eigenvalues are $\{2, 1, 1\}$ and the eigenvector(s) are

$$\{2, \{-1, 1, 0\}\} \quad \{1, \{1, 0, 1\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{-3, -3, -3\}$ and the eigenvector(s) are

$$\{-3, \{-1, 2, 0\}\}$$

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[46] **Answers for Set No: XLVI**

(a) The eigenvalues are $\{3, 1, 0\}$ and the eigenvector(s) are

$$\{3, \{-1, 2, 1\}\} \quad \{1, \{-1, 1, 0\}\} \quad \{0, \{-1, 1, 1\}\}$$

(b) The eigenvalues are $\{-3, -3, -1\}$ and the eigenvector(s) are

$$\{-3, \{1, 0, 1\}\} \quad \{-3, \{0, 1, 0\}\} \quad \{-1, \{2, 1, 1\}\}$$

(c) The eigenvalues are $\{3, 3, 2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{2, \{1, 1, 0\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{0, 0, 1\}\} \quad \{-2, \{-1, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, -1, 1\}\}$$

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[47] **Answers for Set No: XLVII**

(a) The eigenvalues are $\{4, 2, -1\}$ and the eigenvector(s) are

$$\{4, \{-1, 1, 1\}\} \quad \{2, \{-2, 3, 1\}\} \quad \{-1, \{-1, 1, 0\}\}$$

(b) The eigenvalues are $\{-3, -1, -1\}$ and the eigenvector(s) are

$$\{-3, \{2, 1, 1\}\} \quad \{-1, \{1, 0, 1\}\} \quad \{-1, \{0, 1, 0\}\}$$

(c) The eigenvalues are $\{3, 2, 2\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\} \quad \{2, \{1, -1, 3\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 1, 1\}\} \quad \{-1, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, 1, 0\}\}$$

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[48] **Answers for Set No: XLVIII**

(a) The eigenvalues are $\{4, -2, 1\}$ and the eigenvector(s) are

$$\{4, \{-1, 1, 1\}\} \quad \{-2, \{0, 1, 0\}\} \quad \{1, \{-2, 2, 1\}\}$$

(b) The eigenvalues are $\{-2, -2, -1\}$ and the eigenvector(s) are

$$\{-2, \{1, 0, 1\}\} \quad \{-2, \{-1, 2, 0\}\} \quad \{-1, \{2, -3, 1\}\}$$

(c) The eigenvalues are $\{2, 2, -1\}$ and the eigenvector(s) are

$$\{2, \{1, 1, 0\}\} \quad \{-1, \{-2, -1, 2\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{2, 1, 1\}\}$$

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[49] **Answers for Set No: XLIX**

(a) The eigenvalues are $\{4, -2, 1\}$ and the eigenvector(s) are

$$\{4, \{-1, 1, 1\}\} \quad \{-2, \{-1, 1, 0\}\} \quad \{1, \{-2, 1, 1\}\}$$

(b) The eigenvalues are $\{-2, -1, -1\}$ and the eigenvector(s) are

$$\{-2, \{3, 1, 0\}\} \quad \{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(c) The eigenvalues are $\{-2, -2, 1\}$ and the eigenvector(s) are

$$\{-2, \{-3, 1, 2\}\} \quad \{1, \{-1, 1, 1\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{2, 1, 2\}\}$$

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[50] **Answers for Set No: L**

(a) The eigenvalues are $\{-3, 2, 0\}$ and the eigenvector(s) are

$$\{-3, \{0, 1, 0\}\} \quad \{2, \{-1, 1, 1\}\} \quad \{0, \{-2, 2, 1\}\}$$

(b) The eigenvalues are $\{3, -1, -1\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\} \quad \{-1, \{1, 0, 2\}\} \quad \{-1, \{1, 1, 0\}\}$$

(c) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{-2, \{-3, -1, 2\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 1, 2\}\} \quad \{-1, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 1\}\}$$

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[51] **Answers for Set No: LI**

(a) The eigenvalues are $\{4,1,0\}$ and the eigenvector(s) are

$$\{4,\{0,1,0\}\} \quad \{1,\{1,1,1\}\} \quad \{0,\{3,3,2\}\}$$

(b) The eigenvalues are $\{-1,-1,0\}$ and the eigenvector(s) are

$$\{-1,\{-3,0,1\}\} \quad \{-1,\{1,1,0\}\} \quad \{0,\{-1,1,1\}\}$$

(c) The eigenvalues are $\{-1,1,1\}$ and the eigenvector(s) are

$$\{-1,\{2,1,2\}\} \quad \{1,\{1,1,2\}\}$$

(d) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\} \quad \{1,\{2,1,0\}\}$$

(e) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\}$$

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[52] **Answers for Set No: LII**

(a) The eigenvalues are $\{-2,1,0\}$ and the eigenvector(s) are

$$\{-2,\{0,1,0\}\} \quad \{1,\{1,2,1\}\} \quad \{0,\{3,6,2\}\}$$

(b) The eigenvalues are $\{-1,-1,0\}$ and the eigenvector(s) are

$$\{-1,\{0,3,1\}\} \quad \{-1,\{1,0,0\}\} \quad \{0,\{2,2,1\}\}$$

(c) The eigenvalues are $\{-1,-1,0\}$ and the eigenvector(s) are

$$\{-1,\{1,0,0\}\} \quad \{0,\{2,2,1\}\}$$

(d) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{2,0,1\}\} \quad \{1,\{0,1,0\}\}$$

(e) The eigenvalues are $\{2,2,2\}$ and the eigenvector(s) are

$$\{2,\{-1,0,2\}\}$$

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[53] **Answers for Set No: LIII**

(a) The eigenvalues are $\{-2,-1,0\}$ and the eigenvector(s) are

$$\{-2,\{-1,-1,1\}\} \quad \{-1,\{1,1,0\}\} \quad \{0,\{0,-1,1\}\}$$

(b) The eigenvalues are $\{1,1,0\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\} \quad \{1,\{1,1,0\}\} \quad \{0,\{2,1,0\}\}$$

(c) The eigenvalues are $\{2,1,1\}$ and the eigenvector(s) are

$$\{2,\{-1,1,0\}\} \quad \{1,\{1,0,1\}\}$$

(d) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\} \quad \{1,\{2,1,0\}\}$$

(e) The eigenvalues are $\{2,2,2\}$ and the eigenvector(s) are

$$\{2,\{-1,0,2\}\}$$

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[54] **Answers for Set No: LIV**

(a) The eigenvalues are $\{-4,2,0\}$ and the eigenvector(s) are

$$\{-4,\{-1,1,0\}\} \quad \{2,\{-1,1,1\}\} \quad \{0,\{-2,1,1\}\}$$

(b) The eigenvalues are $\{-3,-3,1\}$ and the eigenvector(s) are

$$\{-3,\{0,1,1\}\} \quad \{-3,\{1,0,0\}\} \quad \{1,\{-2,1,0\}\}$$

(c) The eigenvalues are $\{3,3,2\}$ and the eigenvector(s) are

$$\{3,\{-1,-1,1\}\} \quad \{2,\{1,1,0\}\}$$

(d) The eigenvalues are $\{2,2,2\}$ and the eigenvector(s) are

$$\{2,\{0,-1,2\}\} \quad \{2,\{1,0,0\}\}$$

(e) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\}$$

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[55] **Answers for Set No: LV**

(a) The eigenvalues are $\{2,-1,0\}$ and the eigenvector(s) are

$$\{2,\{1,3,1\}\} \quad \{-1,\{0,1,1\}\} \quad \{0,\{1,2,1\}\}$$

(b) The eigenvalues are $\{1,1,0\}$ and the eigenvector(s) are

$$\{1,\{0,-1,2\}\} \quad \{1,\{1,0,0\}\} \quad \{0,\{-3,-1,1\}\}$$

(c) The eigenvalues are $\{3,2,2\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\} \quad \{2,\{1,-1,3\}\}$$

(d) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{2,0,1\}\} \quad \{3,\{1,1,0\}\}$$

(e) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\}$$

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[56] **Answers for Set No: LVI**

(a) The eigenvalues are $\{-2,1,0\}$ and the eigenvector(s) are

$$\{-2,\{0,-1,1\}\} \quad \{1,\{1,1,0\}\} \quad \{0,\{-3,-4,2\}\}$$

(b) The eigenvalues are $\{2,1,1\}$ and the eigenvector(s) are

$$\{2,\{-1,0,2\}\} \quad \{1,\{0,0,1\}\} \quad \{1,\{-2,1,0\}\}$$

(c) The eigenvalues are $\{2,2,-1\}$ and the eigenvector(s) are

$$\{2,\{1,1,0\}\} \quad \{-1,\{-2,-1,2\}\}$$

(d) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{1,0,2\}\} \quad \{3,\{1,1,0\}\}$$

(e) The eigenvalues are $\{-3,-3,-3\}$ and the eigenvector(s) are

$$\{-3,\{-1,2,0\}\}$$

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[57] **Answers for Set No: LVII**

(a) The eigenvalues are $\{-3, 1, 0\}$ and the eigenvector(s) are

$$\{-3, \{0, -1, 1\}\} \quad \{1, \{1, 1, 0\}\} \quad \{0, \{-3, -4, 2\}\}$$

(b) The eigenvalues are $\{-2, 2, 2\}$ and the eigenvector(s) are

$$\{-2, \{1, 0, 1\}\} \quad \{2, \{0, 0, 1\}\} \quad \{2, \{1, 1, 0\}\}$$

(c) The eigenvalues are $\{-2, -2, 1\}$ and the eigenvector(s) are

$$\{-2, \{-3, 1, 2\}\} \quad \{1, \{-1, 1, 1\}\}$$

(d) The eigenvalues are $\{-3, -3, -3\}$ and the eigenvector(s) are

$$\{-3, \{-1, 0, 1\}\} \quad \{-3, \{-1, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, -1, 1\}\}$$

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[58] **Answers for Set No: LVIII**

(a) The eigenvalues are $\{2, -1, 0\}$ and the eigenvector(s) are

$$\{2, \{-1, 1, 0\}\} \quad \{-1, \{1, -1, 1\}\} \quad \{0, \{3, -2, 1\}\}$$

(b) The eigenvalues are $\{2, 2, 0\}$ and the eigenvector(s) are

$$\{2, \{1, 0, 2\}\} \quad \{2, \{1, 2, 0\}\} \quad \{0, \{0, -2, 1\}\}$$

(c) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{-2, \{-3, -1, 2\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-2, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, 1, 0\}\}$$

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[59] **Answers for Set No: LIX**

(a) The eigenvalues are $\{-2,-1,0\}$ and the eigenvector(s) are

$$\{-2,\{-1,0,1\}\} \quad \{-1,\{-3,1,3\}\} \quad \{0,\{-1,1,2\}\}$$

(b) The eigenvalues are $\{2,2,1\}$ and the eigenvector(s) are

$$\{2,\{0,0,1\}\} \quad \{2,\{-1,1,0\}\} \quad \{1,\{1,0,1\}\}$$

(c) The eigenvalues are $\{-1,1,1\}$ and the eigenvector(s) are

$$\{-1,\{2,1,2\}\} \quad \{1,\{1,1,2\}\}$$

(d) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-1,0,1\}\} \quad \{-2,\{1,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{2,1,1\}\}$$

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[60] **Answers for Set No: LX**

(a) The eigenvalues are $\{5,2,1\}$ and the eigenvector(s) are

$$\{5,\{-1,1,1\}\} \quad \{2,\{-2,1,1\}\} \quad \{1,\{-1,1,0\}\}$$

(b) The eigenvalues are $\{3,3,2\}$ and the eigenvector(s) are

$$\{3,\{-1,0,3\}\} \quad \{3,\{4,3,0\}\} \quad \{2,\{1,1,0\}\}$$

(c) The eigenvalues are $\{-1,-1,0\}$ and the eigenvector(s) are

$$\{-1,\{1,0,0\}\} \quad \{0,\{2,2,1\}\}$$

(d) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{0,0,1\}\} \quad \{-2,\{-1,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{2,1,2\}\}$$

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[61] **Answers for Set No: LXI**

(a) The eigenvalues are $\{-3,-1,0\}$ and the eigenvector(s) are

$$\{-3,\{1,1,0\}\} \quad \{-1,\{-1,-1,1\}\} \quad \{0,\{0,-1,1\}\}$$

(b) The eigenvalues are $\{3,3,1\}$ and the eigenvector(s) are

$$\{3,\{0,-1,1\}\} \quad \{3,\{1,0,0\}\} \quad \{1,\{1,0,1\}\}$$

(c) The eigenvalues are $\{2,1,1\}$ and the eigenvector(s) are

$$\{2,\{-1,1,0\}\} \quad \{1,\{1,0,1\}\}$$

(d) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{0,1,1\}\} \quad \{-1,\{1,0,0\}\}$$

(e) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{1,0,1\}\}$$

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[62] **Answers for Set No: LXII**

(a) The eigenvalues are $\{-4,3,0\}$ and the eigenvector(s) are

$$\{-4,\{1,0,1\}\} \quad \{3,\{-1,1,1\}\} \quad \{0,\{-1,1,0\}\}$$

(b) The eigenvalues are $\{3,3,1\}$ and the eigenvector(s) are

$$\{3,\{-1,0,1\}\} \quad \{3,\{0,1,0\}\} \quad \{1,\{-1,-1,2\}\}$$

(c) The eigenvalues are $\{3,3,2\}$ and the eigenvector(s) are

$$\{3,\{-1,-1,1\}\} \quad \{2,\{1,1,0\}\}$$

(d) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{0,0,1\}\} \quad \{-1,\{2,1,0\}\}$$

(e) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\}$$

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[63] **Answers for Set No: LXIII**

(a) The eigenvalues are $\{3, 1, 0\}$ and the eigenvector(s) are

$$\{3, \{-1, 1, 1\}\} \quad \{1, \{-2, 1, 1\}\} \quad \{0, \{-1, 1, 0\}\}$$

(b) The eigenvalues are $\{3, 3, 2\}$ and the eigenvector(s) are

$$\{3, \{0, 0, 1\}\} \quad \{3, \{-1, 2, 0\}\} \quad \{2, \{-1, 1, 2\}\}$$

(c) The eigenvalues are $\{3, 2, 2\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\} \quad \{2, \{1, -1, 3\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[64] **Answers for Set No: LXIV**

(a) The eigenvalues are $\{7, 3, -1\}$ and the eigenvector(s) are

$$\{7, \{-1, 1, 1\}\} \quad \{3, \{-2, 3, 1\}\} \quad \{-1, \{-1, 1, 0\}\}$$

(b) The eigenvalues are $\{-3, -3, -1\}$ and the eigenvector(s) are

$$\{-3, \{0, -1, 1\}\} \quad \{-3, \{1, 0, 0\}\} \quad \{-1, \{2, 0, 1\}\}$$

(c) The eigenvalues are $\{2, 2, -1\}$ and the eigenvector(s) are

$$\{2, \{1, 1, 0\}\} \quad \{-1, \{-2, -1, 2\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 1, 2\}\} \quad \{-1, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[65] **Answers for Set No: LXV**

(a) The eigenvalues are $\{5, 2, -1\}$ and the eigenvector(s) are

$$\{5, \{-1, 1, 1\}\} \quad \{2, \{-2, 3, 1\}\} \quad \{-1, \{-1, 1, 0\}\}$$

(b) The eigenvalues are $\{-3, -2, -2\}$ and the eigenvector(s) are

$$\{-3, \{-1, 1, 1\}\} \quad \{-2, \{-3, 0, 2\}\} \quad \{-2, \{0, 1, 0\}\}$$

(c) The eigenvalues are $\{-2, -2, 1\}$ and the eigenvector(s) are

$$\{-2, \{-3, 1, 2\}\} \quad \{1, \{-1, 1, 1\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\} \quad \{1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[66] **Answers for Set No: LXVI**

(a) The eigenvalues are $\{4, 2, 1\}$ and the eigenvector(s) are

$$\{4, \{0, 1, 0\}\} \quad \{2, \{-1, 6, 3\}\} \quad \{1, \{-1, 3, 2\}\}$$

(b) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{-2, \{-1, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(c) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{-2, \{-3, -1, 2\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{2, 0, 1\}\} \quad \{1, \{0, 1, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[67] **Answers for Set No: LXVII**

(a) The eigenvalues are $\{-3,-2,0\}$ and the eigenvector(s) are

$$\{-3,\{-1,1,0\}\} \quad \{-2,\{1,-2,1\}\} \quad \{0,\{0,-3,2\}\}$$

(b) The eigenvalues are $\{-3,-3,-1\}$ and the eigenvector(s) are

$$\{-3,\{1,0,1\}\} \quad \{-3,\{0,1,0\}\} \quad \{-1,\{2,1,1\}\}$$

(c) The eigenvalues are $\{-1,1,1\}$ and the eigenvector(s) are

$$\{-1,\{2,1,2\}\} \quad \{1,\{1,1,2\}\}$$

(d) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\} \quad \{1,\{2,1,0\}\}$$

(e) The eigenvalues are $\{-3,-3,-3\}$ and the eigenvector(s) are

$$\{-3,\{-1,2,0\}\}$$

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[68] **Answers for Set No: LXVIII**

(a) The eigenvalues are $\{-4,3,-2\}$ and the eigenvector(s) are

$$\{-4,\{-1,1,0\}\} \quad \{3,\{-1,1,1\}\} \quad \{-2,\{-2,3,1\}\}$$

(b) The eigenvalues are $\{-3,-1,-1\}$ and the eigenvector(s) are

$$\{-3,\{2,1,1\}\} \quad \{-1,\{1,0,1\}\} \quad \{-1,\{0,1,0\}\}$$

(c) The eigenvalues are $\{-1,-1,0\}$ and the eigenvector(s) are

$$\{-1,\{1,0,0\}\} \quad \{0,\{2,2,1\}\}$$

(d) The eigenvalues are $\{2,2,2\}$ and the eigenvector(s) are

$$\{2,\{0,-1,2\}\} \quad \{2,\{1,0,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-1,-1,1\}\}$$

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[69] **Answers for Set No: LXIX**

(a) The eigenvalues are $\{-3,-2,0\}$ and the eigenvector(s) are

$$\{-3,\{-1,1,1\}\} \quad \{-2,\{-1,1,2\}\} \quad \{0,\{-1,0,1\}\}$$

(b) The eigenvalues are $\{-2,-2,-1\}$ and the eigenvector(s) are

$$\{-2,\{1,0,1\}\} \quad \{-2,\{-1,2,0\}\} \quad \{-1,\{2,-3,1\}\}$$

(c) The eigenvalues are $\{2,1,1\}$ and the eigenvector(s) are

$$\{2,\{-1,1,0\}\} \quad \{1,\{1,0,1\}\}$$

(d) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{2,0,1\}\} \quad \{3,\{1,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-1,1,0\}\}$$

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[70] **Answers for Set No: LXX**

(a) The eigenvalues are $\{4,3,-1\}$ and the eigenvector(s) are

$$\{4,\{3,2,3\}\} \quad \{3,\{2,1,2\}\} \quad \{-1,\{1,0,0\}\}$$

(b) The eigenvalues are $\{-2,-1,-1\}$ and the eigenvector(s) are

$$\{-2,\{3,1,0\}\} \quad \{-1,\{0,0,1\}\} \quad \{-1,\{2,1,0\}\}$$

(c) The eigenvalues are $\{3,3,2\}$ and the eigenvector(s) are

$$\{3,\{-1,-1,1\}\} \quad \{2,\{1,1,0\}\}$$

(d) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{1,0,2\}\} \quad \{3,\{1,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{2,1,1\}\}$$

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[71] **Answers for Set No: LXXI**

(a) The eigenvalues are $\{4, 3, -1\}$ and the eigenvector(s) are

$$\{4, \{1, 1, 2\}\} \quad \{3, \{1, 2, 3\}\} \quad \{-1, \{1, 1, 1\}\}$$

(b) The eigenvalues are $\{3, -1, -1\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\} \quad \{-1, \{1, 0, 2\}\} \quad \{-1, \{1, 1, 0\}\}$$

(c) The eigenvalues are $\{3, 2, 2\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\} \quad \{2, \{1, -1, 3\}\}$$

(d) The eigenvalues are $\{-3, -3, -3\}$ and the eigenvector(s) are

$$\{-3, \{-1, 0, 1\}\} \quad \{-3, \{-1, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{2, 1, 2\}\}$$

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[72] **Answers for Set No: LXXII**

(a) The eigenvalues are $\{-3, 1, 0\}$ and the eigenvector(s) are

$$\{-3, \{1, 1, 0\}\} \quad \{1, \{0, -1, 1\}\} \quad \{0, \{-1, -1, 1\}\}$$

(b) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{-3, 0, 1\}\} \quad \{-1, \{1, 1, 0\}\} \quad \{0, \{-1, 1, 1\}\}$$

(c) The eigenvalues are $\{2, 2, -1\}$ and the eigenvector(s) are

$$\{2, \{1, 1, 0\}\} \quad \{-1, \{-2, -1, 2\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-2, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 1\}\}$$

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[73] **Answers for Set No: LXXIII**

(a) The eigenvalues are $\{-2, 1, 0\}$ and the eigenvector(s) are

$$\{-2, \{0, 1, 1\}\} \quad \{1, \{-3, 8, 7\}\} \quad \{0, \{-1, 3, 3\}\}$$

(b) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{0, 3, 1\}\} \quad \{-1, \{1, 0, 0\}\} \quad \{0, \{2, 2, 1\}\}$$

(c) The eigenvalues are $\{-2, -2, 1\}$ and the eigenvector(s) are

$$\{-2, \{-3, 1, 2\}\} \quad \{1, \{-1, 1, 1\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\}$$

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[74] **Answers for Set No: LXXIV**

(a) The eigenvalues are $\{-2, 1, 0\}$ and the eigenvector(s) are

$$\{-2, \{1, 1, 0\}\} \quad \{1, \{0, -1, 1\}\} \quad \{0, \{-1, -1, 1\}\}$$

(b) The eigenvalues are $\{1, 1, 0\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\} \quad \{1, \{1, 1, 0\}\} \quad \{0, \{2, 1, 0\}\}$$

(c) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{-2, \{-3, -1, 2\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{0, 0, 1\}\} \quad \{-2, \{-1, 1, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[75] **Answers for Set No: LXXV**

(a) The eigenvalues are $\{4,2,0\}$ and the eigenvector(s) are

$$\{4,\{-1,1,1\}\} \quad \{2,\{-2,1,1\}\} \quad \{0,\{0,1,0\}\}$$

(b) The eigenvalues are $\{-3,-3,1\}$ and the eigenvector(s) are

$$\{-3,\{0,1,1\}\} \quad \{-3,\{1,0,0\}\} \quad \{1,\{-2,1,0\}\}$$

(c) The eigenvalues are $\{-1,1,1\}$ and the eigenvector(s) are

$$\{-1,\{2,1,2\}\} \quad \{1,\{1,1,2\}\}$$

(d) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{0,1,1\}\} \quad \{-1,\{1,0,0\}\}$$

(e) The eigenvalues are $\{2,2,2\}$ and the eigenvector(s) are

$$\{2,\{-1,0,2\}\}$$

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[76] **Answers for Set No: LXXVI**

(a) The eigenvalues are $\{4,2,0\}$ and the eigenvector(s) are

$$\{4,\{-1,1,1\}\} \quad \{2,\{-2,1,1\}\} \quad \{0,\{-1,1,0\}\}$$

(b) The eigenvalues are $\{1,1,0\}$ and the eigenvector(s) are

$$\{1,\{0,-1,2\}\} \quad \{1,\{1,0,0\}\} \quad \{0,\{-3,-1,1\}\}$$

(c) The eigenvalues are $\{-1,-1,0\}$ and the eigenvector(s) are

$$\{-1,\{1,0,0\}\} \quad \{0,\{2,2,1\}\}$$

(d) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{0,0,1\}\} \quad \{-1,\{2,1,0\}\}$$

(e) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\}$$

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[77] **Answers for Set No: LXXVII**

(a) The eigenvalues are $\{-4, 3, -1\}$ and the eigenvector(s) are

$$\{-4, \{1, 0, 1\}\} \quad \{3, \{-1, 1, 1\}\} \quad \{-1, \{-1, 1, 0\}\}$$

(b) The eigenvalues are $\{2, 1, 1\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\} \quad \{1, \{0, 0, 1\}\} \quad \{1, \{-2, 1, 0\}\}$$

(c) The eigenvalues are $\{2, 1, 1\}$ and the eigenvector(s) are

$$\{2, \{-1, 1, 0\}\} \quad \{1, \{1, 0, 1\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[78] **Answers for Set No: LXXVIII**

(a) The eigenvalues are $\{2, 1, 0\}$ and the eigenvector(s) are

$$\{2, \{-2, -2, 1\}\} \quad \{1, \{-2, -1, 2\}\} \quad \{0, \{-1, 0, 1\}\}$$

(b) The eigenvalues are $\{-2, 2, 2\}$ and the eigenvector(s) are

$$\{-2, \{1, 0, 1\}\} \quad \{2, \{0, 0, 1\}\} \quad \{2, \{1, 1, 0\}\}$$

(c) The eigenvalues are $\{3, 3, 2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{2, \{1, 1, 0\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 1, 2\}\} \quad \{-1, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{-3, -3, -3\}$ and the eigenvector(s) are

$$\{-3, \{-1, 2, 0\}\}$$

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[79] **Answers for Set No: LXXIX**

(a) The eigenvalues are $\{5, 3, 0\}$ and the eigenvector(s) are

$$\{5, \{1, -1, 1\}\} \quad \{3, \{1, -2, 1\}\} \quad \{0, \{1, 0, 0\}\}$$

(b) The eigenvalues are $\{2, 2, 0\}$ and the eigenvector(s) are

$$\{2, \{1, 0, 2\}\} \quad \{2, \{1, 2, 0\}\} \quad \{0, \{0, -2, 1\}\}$$

(c) The eigenvalues are $\{3, 2, 2\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\} \quad \{2, \{1, -1, 3\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\} \quad \{1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, -1, 1\}\}$$

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[80] **Answers for Set No: LXXX**

(a) The eigenvalues are $\{-4, -3, 2\}$ and the eigenvector(s) are

$$\{-4, \{-1, 1, 0\}\} \quad \{-3, \{-2, 3, 1\}\} \quad \{2, \{-1, 1, 1\}\}$$

(b) The eigenvalues are $\{2, 2, 1\}$ and the eigenvector(s) are

$$\{2, \{0, 0, 1\}\} \quad \{2, \{-1, 1, 0\}\} \quad \{1, \{1, 0, 1\}\}$$

(c) The eigenvalues are $\{2, 2, -1\}$ and the eigenvector(s) are

$$\{2, \{1, 1, 0\}\} \quad \{-1, \{-2, -1, 2\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{2, 0, 1\}\} \quad \{1, \{0, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, 1, 0\}\}$$

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[81] **Answers for Set No: LXXXI**

(a) The eigenvalues are $\{-4, 2, 1\}$ and the eigenvector(s) are

$$\{-4, \{-1, 1, 0\}\} \quad \{2, \{-1, 1, 1\}\} \quad \{1, \{-2, 1, 1\}\}$$

(b) The eigenvalues are $\{3, 3, 2\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 3\}\} \quad \{3, \{4, 3, 0\}\} \quad \{2, \{1, 1, 0\}\}$$

(c) The eigenvalues are $\{-2, -2, 1\}$ and the eigenvector(s) are

$$\{-2, \{-3, 1, 2\}\} \quad \{1, \{-1, 1, 1\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\} \quad \{1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{2, 1, 1\}\}$$

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[82] **Answers for Set No: LXXXII**

(a) The eigenvalues are $\{4, 2, 0\}$ and the eigenvector(s) are

$$\{4, \{-1, 1, 2\}\} \quad \{2, \{-2, 3, 4\}\} \quad \{0, \{-1, 3, 3\}\}$$

(b) The eigenvalues are $\{3, 3, 1\}$ and the eigenvector(s) are

$$\{3, \{0, -1, 1\}\} \quad \{3, \{1, 0, 0\}\} \quad \{1, \{1, 0, 1\}\}$$

(c) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{-2, \{-3, -1, 2\}\}$$

(d) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{0, -1, 2\}\} \quad \{2, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{2, 1, 2\}\}$$

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[83] **Answers for Set No: LXXXIII**

(a) The eigenvalues are $\{3,1,0\}$ and the eigenvector(s) are

$$\{3,\{-1,1,0\}\} \quad \{1,\{-1,0,1\}\} \quad \{0,\{-2,-1,2\}\}$$

(b) The eigenvalues are $\{3,3,1\}$ and the eigenvector(s) are

$$\{3,\{-1,0,1\}\} \quad \{3,\{0,1,0\}\} \quad \{1,\{-1,-1,2\}\}$$

(c) The eigenvalues are $\{-1,1,1\}$ and the eigenvector(s) are

$$\{-1,\{2,1,2\}\} \quad \{1,\{1,1,2\}\}$$

(d) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{2,0,1\}\} \quad \{3,\{1,1,0\}\}$$

(e) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{1,0,1\}\}$$

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[84] **Answers for Set No: LXXXIV**

(a) The eigenvalues are $\{-2,-1,0\}$ and the eigenvector(s) are

$$\{-2,\{0,1,1\}\} \quad \{-1,\{1,3,1\}\} \quad \{0,\{1,2,1\}\}$$

(b) The eigenvalues are $\{3,3,2\}$ and the eigenvector(s) are

$$\{3,\{0,0,1\}\} \quad \{3,\{-1,2,0\}\} \quad \{2,\{-1,1,2\}\}$$

(c) The eigenvalues are $\{-1,-1,0\}$ and the eigenvector(s) are

$$\{-1,\{1,0,0\}\} \quad \{0,\{2,2,1\}\}$$

(d) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{1,0,2\}\} \quad \{3,\{1,1,0\}\}$$

(e) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\}$$

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[85] **Answers for Set No: LXXXV**

(a) The eigenvalues are $\{2, 1, 0\}$ and the eigenvector(s) are

$$\{2, \{-1, 1, 0\}\} \quad \{1, \{-1, 2, 1\}\} \quad \{0, \{-1, 1, 1\}\}$$

(b) The eigenvalues are $\{-3, -3, -1\}$ and the eigenvector(s) are

$$\{-3, \{0, -1, 1\}\} \quad \{-3, \{1, 0, 0\}\} \quad \{-1, \{2, 0, 1\}\}$$

(c) The eigenvalues are $\{2, 1, 1\}$ and the eigenvector(s) are

$$\{2, \{-1, 1, 0\}\} \quad \{1, \{1, 0, 1\}\}$$

(d) The eigenvalues are $\{-3, -3, -3\}$ and the eigenvector(s) are

$$\{-3, \{-1, 0, 1\}\} \quad \{-3, \{-1, 1, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[86] **Answers for Set No: LXXXVI**

(a) The eigenvalues are $\{5, 3, 1\}$ and the eigenvector(s) are

$$\{5, \{-1, 1, 1\}\} \quad \{3, \{-2, 1, 1\}\} \quad \{1, \{-1, 1, 0\}\}$$

(b) The eigenvalues are $\{-3, -2, -2\}$ and the eigenvector(s) are

$$\{-3, \{-1, 1, 1\}\} \quad \{-2, \{-3, 0, 2\}\} \quad \{-2, \{0, 1, 0\}\}$$

(c) The eigenvalues are $\{3, 3, 2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{2, \{1, 1, 0\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-2, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[87] **Answers for Set No: LXXXVII**

(a) The eigenvalues are $\{3, 2, 0\}$ and the eigenvector(s) are

$$\{3, \{-1, 1, 1\}\} \quad \{2, \{-2, 1, 1\}\} \quad \{0, \{0, 1, 0\}\}$$

(b) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{-2, \{-1, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(c) The eigenvalues are $\{3, 2, 2\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\} \quad \{2, \{1, -1, 3\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[88] **Answers for Set No: LXXXVIII**

(a) The eigenvalues are $\{-5, -2, 1\}$ and the eigenvector(s) are

$$\{-5, \{-2, 1, 2\}\} \quad \{-2, \{-2, 2, 1\}\} \quad \{1, \{-1, 1, 0\}\}$$

(b) The eigenvalues are $\{-3, -3, -1\}$ and the eigenvector(s) are

$$\{-3, \{1, 0, 1\}\} \quad \{-3, \{0, 1, 0\}\} \quad \{-1, \{2, 1, 1\}\}$$

(c) The eigenvalues are $\{2, 2, -1\}$ and the eigenvector(s) are

$$\{2, \{1, 1, 0\}\} \quad \{-1, \{-2, -1, 2\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{0, 0, 1\}\} \quad \{-2, \{-1, 1, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[89] **Answers for Set No: LXXXIX**

(a) The eigenvalues are $\{3, 1, 0\}$ and the eigenvector(s) are

$$\{3, \{-1, 1, 1\}\} \quad \{1, \{-2, 3, 1\}\} \quad \{0, \{-1, 1, 0\}\}$$

(b) The eigenvalues are $\{-3, -1, -1\}$ and the eigenvector(s) are

$$\{-3, \{2, 1, 1\}\} \quad \{-1, \{1, 0, 1\}\} \quad \{-1, \{0, 1, 0\}\}$$

(c) The eigenvalues are $\{-2, -2, 1\}$ and the eigenvector(s) are

$$\{-2, \{-3, 1, 2\}\} \quad \{1, \{-1, 1, 1\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 1, 1\}\} \quad \{-1, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{-3, -3, -3\}$ and the eigenvector(s) are

$$\{-3, \{-1, 2, 0\}\}$$

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[90] **Answers for Set No: XC**

(a) The eigenvalues are $\{3, 2, 0\}$ and the eigenvector(s) are

$$\{3, \{-1, 1, 1\}\} \quad \{2, \{-2, 1, 1\}\} \quad \{0, \{-1, 1, 0\}\}$$

(b) The eigenvalues are $\{-2, -2, -1\}$ and the eigenvector(s) are

$$\{-2, \{1, 0, 1\}\} \quad \{-2, \{-1, 2, 0\}\} \quad \{-1, \{2, -3, 1\}\}$$

(c) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{-2, \{-3, -1, 2\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, -1, 1\}\}$$

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[91] **Answers for Set No: XCI**

(a) The eigenvalues are $\{-3,-2,0\}$ and the eigenvector(s) are

$$\{-3,\{1,-1,3\}\} \quad \{-2,\{1,-1,2\}\} \quad \{0,\{1,0,1\}\}$$

(b) The eigenvalues are $\{-2,-1,-1\}$ and the eigenvector(s) are

$$\{-2,\{3,1,0\}\} \quad \{-1,\{0,0,1\}\} \quad \{-1,\{2,1,0\}\}$$

(c) The eigenvalues are $\{-1,1,1\}$ and the eigenvector(s) are

$$\{-1,\{2,1,2\}\} \quad \{1,\{1,1,2\}\}$$

(d) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{0,0,1\}\} \quad \{-1,\{2,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-1,1,0\}\}$$

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[92] **Answers for Set No: XCII**

(a) The eigenvalues are $\{3,-1,0\}$ and the eigenvector(s) are

$$\{3,\{0,-1,1\}\} \quad \{-1,\{1,-3,1\}\} \quad \{0,\{1,-2,1\}\}$$

(b) The eigenvalues are $\{3,-1,-1\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\} \quad \{-1,\{1,0,2\}\} \quad \{-1,\{1,1,0\}\}$$

(c) The eigenvalues are $\{-1,-1,0\}$ and the eigenvector(s) are

$$\{-1,\{1,0,0\}\} \quad \{0,\{2,2,1\}\}$$

(d) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{0,1,2\}\} \quad \{-1,\{1,0,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{2,1,1\}\}$$

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[93] **Answers for Set No: XCIII**

(a) The eigenvalues are $\{7, 2, -1\}$ and the eigenvector(s) are

$$\{7, \{-1, 1, 1\}\} \quad \{2, \{-2, 3, 1\}\} \quad \{-1, \{-1, 1, 0\}\}$$

(b) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{-3, 0, 1\}\} \quad \{-1, \{1, 1, 0\}\} \quad \{0, \{-1, 1, 1\}\}$$

(c) The eigenvalues are $\{2, 1, 1\}$ and the eigenvector(s) are

$$\{2, \{-1, 1, 0\}\} \quad \{1, \{1, 0, 1\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\} \quad \{1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{2, 1, 2\}\}$$

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[94] **Answers for Set No: XCIV**

(a) The eigenvalues are $\{5, 3, 0\}$ and the eigenvector(s) are

$$\{5, \{1, 3, 1\}\} \quad \{3, \{1, 2, 1\}\} \quad \{0, \{0, 1, 1\}\}$$

(b) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{0, 3, 1\}\} \quad \{-1, \{1, 0, 0\}\} \quad \{0, \{2, 2, 1\}\}$$

(c) The eigenvalues are $\{3, 3, 2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{2, \{1, 1, 0\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{2, 0, 1\}\} \quad \{1, \{0, 1, 0\}\}$$

(e) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 1\}\}$$

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[95] **Answers for Set No: XCV**

(a) The eigenvalues are $\{-2, 1, 0\}$ and the eigenvector(s) are

$$\{-2, \{0, -3, 2\}\} \quad \{1, \{1, 0, 0\}\} \quad \{0, \{-1, -1, 1\}\}$$

(b) The eigenvalues are $\{1, 1, 0\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\} \quad \{1, \{1, 1, 0\}\} \quad \{0, \{2, 1, 0\}\}$$

(c) The eigenvalues are $\{3, 2, 2\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\} \quad \{2, \{1, -1, 3\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\} \quad \{1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\}$$

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[96] **Answers for Set No: XCVI**

(a) The eigenvalues are $\{4, -2, 1\}$ and the eigenvector(s) are

$$\{4, \{0, -1, 1\}\} \quad \{-2, \{-1, -1, 2\}\} \quad \{1, \{-1, -3, 3\}\}$$

(b) The eigenvalues are $\{-3, -3, 1\}$ and the eigenvector(s) are

$$\{-3, \{0, 1, 1\}\} \quad \{-3, \{1, 0, 0\}\} \quad \{1, \{-2, 1, 0\}\}$$

(c) The eigenvalues are $\{2, 2, -1\}$ and the eigenvector(s) are

$$\{2, \{1, 1, 0\}\} \quad \{-1, \{-2, -1, 2\}\}$$

(d) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{0, -1, 2\}\} \quad \{2, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[97] **Answers for Set No: XCVII**

(a) The eigenvalues are $\{4, 2, -1\}$ and the eigenvector(s) are

$$\{4, \{-2, -2, 1\}\} \quad \{2, \{-2, -1, 1\}\} \quad \{-1, \{-1, 0, 1\}\}$$

(b) The eigenvalues are $\{1, 1, 0\}$ and the eigenvector(s) are

$$\{1, \{0, -1, 2\}\} \quad \{1, \{1, 0, 0\}\} \quad \{0, \{-3, -1, 1\}\}$$

(c) The eigenvalues are $\{-2, -2, 1\}$ and the eigenvector(s) are

$$\{-2, \{-3, 1, 2\}\} \quad \{1, \{-1, 1, 1\}\}$$

(d) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{2, 0, 1\}\} \quad \{3, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[98] **Answers for Set No: XCVIII**

(a) The eigenvalues are $\{3, 1, 0\}$ and the eigenvector(s) are

$$\{3, \{1, 1, 2\}\} \quad \{1, \{1, 2, 3\}\} \quad \{0, \{1, 1, 1\}\}$$

(b) The eigenvalues are $\{2, 1, 1\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\} \quad \{1, \{0, 0, 1\}\} \quad \{1, \{-2, 1, 0\}\}$$

(c) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{-2, \{-3, -1, 2\}\}$$

(d) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 2\}\} \quad \{3, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[99] **Answers for Set No: XCIX**

(a) The eigenvalues are $\{4, 1, 0\}$ and the eigenvector(s) are

$$\{4, \{1, -2, 2\}\} \quad \{1, \{1, -2, 3\}\} \quad \{0, \{1, -1, 2\}\}$$

(b) The eigenvalues are $\{-2, 2, 2\}$ and the eigenvector(s) are

$$\{-2, \{1, 0, 1\}\} \quad \{2, \{0, 0, 1\}\} \quad \{2, \{1, 1, 0\}\}$$

(c) The eigenvalues are $\{-1, 1, 1\}$ and the eigenvector(s) are

$$\{-1, \{2, 1, 2\}\} \quad \{1, \{1, 1, 2\}\}$$

(d) The eigenvalues are $\{-3, -3, -3\}$ and the eigenvector(s) are

$$\{-3, \{-1, 0, 1\}\} \quad \{-3, \{-1, 1, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[100] **Answers for Set No: C**

(a) The eigenvalues are $\{3, 2, 1\}$ and the eigenvector(s) are

$$\{3, \{-2, 0, 1\}\} \quad \{2, \{-3, -1, 2\}\} \quad \{1, \{-2, -1, 1\}\}$$

(b) The eigenvalues are $\{2, 2, 0\}$ and the eigenvector(s) are

$$\{2, \{1, 0, 2\}\} \quad \{2, \{1, 2, 0\}\} \quad \{0, \{0, -2, 1\}\}$$

(c) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 0\}\} \quad \{0, \{2, 2, 1\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-2, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{-3, -3, -3\}$ and the eigenvector(s) are

$$\{-3, \{-1, 2, 0\}\}$$

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[101] **Answers for Set No: CI**

(a) The eigenvalues are $\{6,3,1\}$ and the eigenvector(s) are

$$\{6,\{-1,1,0\}\} \quad \{3,\{-1,0,1\}\} \quad \{1,\{-2,-1,2\}\}$$

(b) The eigenvalues are $\{2,2,1\}$ and the eigenvector(s) are

$$\{2,\{0,0,1\}\} \quad \{2,\{-1,1,0\}\} \quad \{1,\{1,0,1\}\}$$

(c) The eigenvalues are $\{2,1,1\}$ and the eigenvector(s) are

$$\{2,\{-1,1,0\}\} \quad \{1,\{1,0,1\}\}$$

(d) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-1,0,1\}\} \quad \{-2,\{1,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-1,-1,1\}\}$$

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[102] **Answers for Set No: CII**

(a) The eigenvalues are $\{3,2,1\}$ and the eigenvector(s) are

$$\{3,\{-1,1,2\}\} \quad \{2,\{-3,2,6\}\} \quad \{1,\{-1,0,1\}\}$$

(b) The eigenvalues are $\{3,3,2\}$ and the eigenvector(s) are

$$\{3,\{-1,0,3\}\} \quad \{3,\{4,3,0\}\} \quad \{2,\{1,1,0\}\}$$

(c) The eigenvalues are $\{3,3,2\}$ and the eigenvector(s) are

$$\{3,\{-1,-1,1\}\} \quad \{2,\{1,1,0\}\}$$

(d) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{0,0,1\}\} \quad \{-2,\{-1,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-1,1,0\}\}$$

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[103] **Answers for Set No: CIII**

(a) The eigenvalues are $\{3, -2, 0\}$ and the eigenvector(s) are

$$\{3, \{0, -1, 1\}\} \quad \{-2, \{-1, -3, 1\}\} \quad \{0, \{-1, -3, 2\}\}$$

(b) The eigenvalues are $\{3, 3, 1\}$ and the eigenvector(s) are

$$\{3, \{0, -1, 1\}\} \quad \{3, \{1, 0, 0\}\} \quad \{1, \{1, 0, 1\}\}$$

(c) The eigenvalues are $\{3, 2, 2\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\} \quad \{2, \{1, -1, 3\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 1, 1\}\} \quad \{-1, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{2, 1, 1\}\}$$

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[104] **Answers for Set No: CIV**

(a) The eigenvalues are $\{4, 1, 0\}$ and the eigenvector(s) are

$$\{4, \{-1, 1, 0\}\} \quad \{1, \{-1, 0, 1\}\} \quad \{0, \{-2, -1, 2\}\}$$

(b) The eigenvalues are $\{3, 3, 1\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{3, \{0, 1, 0\}\} \quad \{1, \{-1, -1, 2\}\}$$

(c) The eigenvalues are $\{2, 2, -1\}$ and the eigenvector(s) are

$$\{2, \{1, 1, 0\}\} \quad \{-1, \{-2, -1, 2\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{2, 1, 2\}\}$$

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[105] **Answers for Set No: CV**

(a) The eigenvalues are $\{4, 3, -2\}$ and the eigenvector(s) are

$$\{4, \{-1, 1, 1\}\} \quad \{3, \{-2, 2, 1\}\} \quad \{-2, \{0, 1, 0\}\}$$

(b) The eigenvalues are $\{3, 3, 2\}$ and the eigenvector(s) are

$$\{3, \{0, 0, 1\}\} \quad \{3, \{-1, 2, 0\}\} \quad \{2, \{-1, 1, 2\}\}$$

(c) The eigenvalues are $\{-2, -2, 1\}$ and the eigenvector(s) are

$$\{-2, \{-3, 1, 2\}\} \quad \{1, \{-1, 1, 1\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 1\}\}$$

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[106] **Answers for Set No: CVI**

(a) The eigenvalues are $\{4, 2, 0\}$ and the eigenvector(s) are

$$\{4, \{0, -1, 1\}\} \quad \{2, \{-1, -3, 3\}\} \quad \{0, \{-1, -1, 2\}\}$$

(b) The eigenvalues are $\{-3, -3, -1\}$ and the eigenvector(s) are

$$\{-3, \{0, -1, 1\}\} \quad \{-3, \{1, 0, 0\}\} \quad \{-1, \{2, 0, 1\}\}$$

(c) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{-2, \{-3, -1, 2\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 1, 2\}\} \quad \{-1, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\}$$

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[107] **Answers for Set No: CVII**

(a) The eigenvalues are $\{-2, 1, 0\}$ and the eigenvector(s) are

$$\{-2, \{1, -3, 1\}\} \quad \{1, \{0, -1, 1\}\} \quad \{0, \{1, -2, 1\}\}$$

(b) The eigenvalues are $\{-3, -2, -2\}$ and the eigenvector(s) are

$$\{-3, \{-1, 1, 1\}\} \quad \{-2, \{-3, 0, 2\}\} \quad \{-2, \{0, 1, 0\}\}$$

(c) The eigenvalues are $\{-1, 1, 1\}$ and the eigenvector(s) are

$$\{-1, \{2, 1, 2\}\} \quad \{1, \{1, 1, 2\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\} \quad \{1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[108] **Answers for Set No: CVIII**

(a) The eigenvalues are $\{3, 1, 0\}$ and the eigenvector(s) are

$$\{3, \{-2, -2, 1\}\} \quad \{1, \{-2, -1, 2\}\} \quad \{0, \{-1, 0, 1\}\}$$

(b) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{-2, \{-1, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(c) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 0\}\} \quad \{0, \{2, 2, 1\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{2, 0, 1\}\} \quad \{1, \{0, 1, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[109] **Answers for Set No: CIX**

(a) The eigenvalues are $\{-2,-1,0\}$ and the eigenvector(s) are

$$\{-2,\{-1,1,1\}\} \quad \{-1,\{-1,1,0\}\} \quad \{0,\{-1,0,2\}\}$$

(b) The eigenvalues are $\{-3,-3,-1\}$ and the eigenvector(s) are

$$\{-3,\{1,0,1\}\} \quad \{-3,\{0,1,0\}\} \quad \{-1,\{2,1,1\}\}$$

(c) The eigenvalues are $\{2,1,1\}$ and the eigenvector(s) are

$$\{2,\{-1,1,0\}\} \quad \{1,\{1,0,1\}\}$$

(d) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\} \quad \{1,\{2,1,0\}\}$$

(e) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\}$$

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[110] **Answers for Set No: CX**

(a) The eigenvalues are $\{3,-2,1\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\} \quad \{-2,\{-1,1,1\}\} \quad \{1,\{2,-1,1\}\}$$

(b) The eigenvalues are $\{-3,-1,-1\}$ and the eigenvector(s) are

$$\{-3,\{2,1,1\}\} \quad \{-1,\{1,0,1\}\} \quad \{-1,\{0,1,0\}\}$$

(c) The eigenvalues are $\{3,3,2\}$ and the eigenvector(s) are

$$\{3,\{-1,-1,1\}\} \quad \{2,\{1,1,0\}\}$$

(d) The eigenvalues are $\{2,2,2\}$ and the eigenvector(s) are

$$\{2,\{0,-1,2\}\} \quad \{2,\{1,0,0\}\}$$

(e) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\}$$

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[111] **Answers for Set No: CXI**

(*a*) The eigenvalues are $\{3, 2, -1\}$ and the eigenvector(s) are

$$\{3, \{0, -1, 1\}\} \quad \{2, \{-1, -3, 3\}\} \quad \{-1, \{-1, -1, 2\}\}$$

(*b*) The eigenvalues are $\{-2, -2, -1\}$ and the eigenvector(s) are

$$\{-2, \{1, 0, 1\}\} \quad \{-2, \{-1, 2, 0\}\} \quad \{-1, \{2, -3, 1\}\}$$

(*c*) The eigenvalues are $\{3, 2, 2\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\} \quad \{2, \{1, -1, 3\}\}$$

(*d*) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{2, 0, 1\}\} \quad \{3, \{1, 1, 0\}\}$$

(*e*) The eigenvalues are $\{-3, -3, -3\}$ and the eigenvector(s) are

$$\{-3, \{-1, 2, 0\}\}$$

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[112] **Answers for Set No: CXII**

(*a*) The eigenvalues are $\{3, 2, -1\}$ and the eigenvector(s) are

$$\{3, \{3, -2, 3\}\} \quad \{2, \{3, -2, 2\}\} \quad \{-1, \{-1, 1, 0\}\}$$

(*b*) The eigenvalues are $\{-2, -1, -1\}$ and the eigenvector(s) are

$$\{-2, \{3, 1, 0\}\} \quad \{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(*c*) The eigenvalues are $\{2, 2, -1\}$ and the eigenvector(s) are

$$\{2, \{1, 1, 0\}\} \quad \{-1, \{-2, -1, 2\}\}$$

(*d*) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 2\}\} \quad \{3, \{1, 1, 0\}\}$$

(*e*) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, -1, 1\}\}$$

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[113] **Answers for Set No: CXIII**

(a) The eigenvalues are $\{3,1,0\}$ and the eigenvector(s) are

$$\{3,\{-2,0,1\}\} \quad \{1,\{-3,-1,2\}\} \quad \{0,\{-2,-1,1\}\}$$

(b) The eigenvalues are $\{3,-1,-1\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\} \quad \{-1,\{1,0,2\}\} \quad \{-1,\{1,1,0\}\}$$

(c) The eigenvalues are $\{-2,-2,1\}$ and the eigenvector(s) are

$$\{-2,\{-3,1,2\}\} \quad \{1,\{-1,1,1\}\}$$

(d) The eigenvalues are $\{-3,-3,-3\}$ and the eigenvector(s) are

$$\{-3,\{-1,0,1\}\} \quad \{-3,\{-1,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-1,1,0\}\}$$

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[114] **Answers for Set No: CXIV**

(a) The eigenvalues are $\{2,1,0\}$ and the eigenvector(s) are

$$\{2,\{1,2,1\}\} \quad \{1,\{1,3,1\}\} \quad \{0,\{0,1,1\}\}$$

(b) The eigenvalues are $\{-1,-1,0\}$ and the eigenvector(s) are

$$\{-1,\{-3,0,1\}\} \quad \{-1,\{1,1,0\}\} \quad \{0,\{-1,1,1\}\}$$

(c) The eigenvalues are $\{3,-2,-2\}$ and the eigenvector(s) are

$$\{3,\{-1,0,1\}\} \quad \{-2,\{-3,-1,2\}\}$$

(d) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-2,0,1\}\} \quad \{-2,\{1,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{2,1,1\}\}$$

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[115] **Answers for Set No: CXV**

(a) The eigenvalues are $\{-3, 1, 0\}$ and the eigenvector(s) are

$$\{-3, \{1, 0, 1\}\} \quad \{1, \{3, -1, 1\}\} \quad \{0, \{2, -1, 1\}\}$$

(b) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{0, 3, 1\}\} \quad \{-1, \{1, 0, 0\}\} \quad \{0, \{2, 2, 1\}\}$$

(c) The eigenvalues are $\{-1, 1, 1\}$ and the eigenvector(s) are

$$\{-1, \{2, 1, 2\}\} \quad \{1, \{1, 1, 2\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{2, 1, 2\}\}$$

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[116] **Answers for Set No: CXVI**

(a) The eigenvalues are $\{6, 1, 0\}$ and the eigenvector(s) are

$$\{6, \{0, 1, 0\}\} \quad \{1, \{3, 6, 2\}\} \quad \{0, \{1, 2, 1\}\}$$

(b) The eigenvalues are $\{1, 1, 0\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\} \quad \{1, \{1, 1, 0\}\} \quad \{0, \{2, 1, 0\}\}$$

(c) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 0\}\} \quad \{0, \{2, 2, 1\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{0, 0, 1\}\} \quad \{-2, \{-1, 1, 0\}\}$$

(e) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 1\}\}$$

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[117] **Answers for Set No: CXVII**

(a) The eigenvalues are $\{3, 2, 1\}$ and the eigenvector(s) are

$$\{3, \{2, 3, 0\}\} \quad \{2, \{-2, -4, 1\}\} \quad \{1, \{-1, -3, 1\}\}$$

(b) The eigenvalues are $\{-3, -3, 1\}$ and the eigenvector(s) are

$$\{-3, \{0, 1, 1\}\} \quad \{-3, \{1, 0, 0\}\} \quad \{1, \{-2, 1, 0\}\}$$

(c) The eigenvalues are $\{2, 1, 1\}$ and the eigenvector(s) are

$$\{2, \{-1, 1, 0\}\} \quad \{1, \{1, 0, 1\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 1, 1\}\} \quad \{-1, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\}$$

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[118] **Answers for Set No: CXVIII**

(a) The eigenvalues are $\{-2, 1, 0\}$ and the eigenvector(s) are

$$\{-2, \{-1, 1, 2\}\} \quad \{1, \{-1, 0, 1\}\} \quad \{0, \{-1, 1, 1\}\}$$

(b) The eigenvalues are $\{1, 1, 0\}$ and the eigenvector(s) are

$$\{1, \{0, -1, 2\}\} \quad \{1, \{1, 0, 0\}\} \quad \{0, \{-3, -1, 1\}\}$$

(c) The eigenvalues are $\{3, 3, 2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{2, \{1, 1, 0\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[119] **Answers for Set No: CXIX**

(a) The eigenvalues are $\{3, 2, 0\}$ and the eigenvector(s) are

$$\{3, \{1, 2, 2\}\} \quad \{2, \{2, 3, 4\}\} \quad \{0, \{0, 1, 1\}\}$$

(b) The eigenvalues are $\{2, 1, 1\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\} \quad \{1, \{0, 0, 1\}\} \quad \{1, \{-2, 1, 0\}\}$$

(c) The eigenvalues are $\{3, 2, 2\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\} \quad \{2, \{1, -1, 3\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[120] **Answers for Set No: CXX**

(a) The eigenvalues are $\{-3, 2, 1\}$ and the eigenvector(s) are

$$\{-3, \{-1, 0, 1\}\} \quad \{2, \{-2, -2, 1\}\} \quad \{1, \{-2, -1, 1\}\}$$

(b) The eigenvalues are $\{-2, 2, 2\}$ and the eigenvector(s) are

$$\{-2, \{1, 0, 1\}\} \quad \{2, \{0, 0, 1\}\} \quad \{2, \{1, 1, 0\}\}$$

(c) The eigenvalues are $\{2, 2, -1\}$ and the eigenvector(s) are

$$\{2, \{1, 1, 0\}\} \quad \{-1, \{-2, -1, 2\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 1, 2\}\} \quad \{-1, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[121] **Answers for Set No: CXXI**

(a) The eigenvalues are $\{5,1,0\}$ and the eigenvector(s) are

$$\{5,\{-1,1,1\}\} \quad \{1,\{-2,3,1\}\} \quad \{0,\{-1,1,0\}\}$$

(b) The eigenvalues are $\{2,2,0\}$ and the eigenvector(s) are

$$\{2,\{1,0,2\}\} \quad \{2,\{1,2,0\}\} \quad \{0,\{0,-2,1\}\}$$

(c) The eigenvalues are $\{-2,-2,1\}$ and the eigenvector(s) are

$$\{-2,\{-3,1,2\}\} \quad \{1,\{-1,1,1\}\}$$

(d) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\} \quad \{1,\{2,1,0\}\}$$

(e) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\}$$

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[122] **Answers for Set No: CXXII**

(a) The eigenvalues are $\{-3,2,1\}$ and the eigenvector(s) are

$$\{-3,\{-1,1,0\}\} \quad \{2,\{3,-2,3\}\} \quad \{1,\{3,-2,2\}\}$$

(b) The eigenvalues are $\{2,2,1\}$ and the eigenvector(s) are

$$\{2,\{0,0,1\}\} \quad \{2,\{-1,1,0\}\} \quad \{1,\{1,0,1\}\}$$

(c) The eigenvalues are $\{3,-2,-2\}$ and the eigenvector(s) are

$$\{3,\{-1,0,1\}\} \quad \{-2,\{-3,-1,2\}\}$$

(d) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{2,0,1\}\} \quad \{1,\{0,1,0\}\}$$

(e) The eigenvalues are $\{-3,-3,-3\}$ and the eigenvector(s) are

$$\{-3,\{-1,2,0\}\}$$

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[123] **Answers for Set No: CXXIII**

(a) The eigenvalues are $\{4,-3,0\}$ and the eigenvector(s) are

$$\{4,\{-1,-1,1\}\} \quad \{-3,\{1,1,0\}\} \quad \{0,\{0,-1,1\}\}$$

(b) The eigenvalues are $\{3,3,2\}$ and the eigenvector(s) are

$$\{3,\{-1,0,3\}\} \quad \{3,\{4,3,0\}\} \quad \{2,\{1,1,0\}\}$$

(c) The eigenvalues are $\{-1,1,1\}$ and the eigenvector(s) are

$$\{-1,\{2,1,2\}\} \quad \{1,\{1,1,2\}\}$$

(d) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\} \quad \{1,\{2,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-1,-1,1\}\}$$

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[124] **Answers for Set No: CXXIV**

(a) The eigenvalues are $\{6,2,1\}$ and the eigenvector(s) are

$$\{6,\{-1,1,0\}\} \quad \{2,\{-1,0,1\}\} \quad \{1,\{-2,-1,2\}\}$$

(b) The eigenvalues are $\{3,3,1\}$ and the eigenvector(s) are

$$\{3,\{0,-1,1\}\} \quad \{3,\{1,0,0\}\} \quad \{1,\{1,0,1\}\}$$

(c) The eigenvalues are $\{-1,-1,0\}$ and the eigenvector(s) are

$$\{-1,\{1,0,0\}\} \quad \{0,\{2,2,1\}\}$$

(d) The eigenvalues are $\{2,2,2\}$ and the eigenvector(s) are

$$\{2,\{0,-1,2\}\} \quad \{2,\{1,0,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-1,1,0\}\}$$

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[125] **Answers for Set No: CXXV**

(a) The eigenvalues are $\{3,2,0\}$ and the eigenvector(s) are

$$\{3,\{-2,2,1\}\} \quad \{2,\{-1,1,1\}\} \quad \{0,\{0,1,0\}\}$$

(b) The eigenvalues are $\{3,3,1\}$ and the eigenvector(s) are

$$\{3,\{-1,0,1\}\} \quad \{3,\{0,1,0\}\} \quad \{1,\{-1,-1,2\}\}$$

(c) The eigenvalues are $\{2,1,1\}$ and the eigenvector(s) are

$$\{2,\{-1,1,0\}\} \quad \{1,\{1,0,1\}\}$$

(d) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{2,0,1\}\} \quad \{3,\{1,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{2,1,1\}\}$$

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[126] **Answers for Set No: CXXVI**

(a) The eigenvalues are $\{3,2,-1\}$ and the eigenvector(s) are

$$\{3,\{-2,1,1\}\} \quad \{2,\{-1,1,1\}\} \quad \{-1,\{0,1,0\}\}$$

(b) The eigenvalues are $\{3,3,2\}$ and the eigenvector(s) are

$$\{3,\{0,0,1\}\} \quad \{3,\{-1,2,0\}\} \quad \{2,\{-1,1,2\}\}$$

(c) The eigenvalues are $\{3,3,2\}$ and the eigenvector(s) are

$$\{3,\{-1,-1,1\}\} \quad \{2,\{1,1,0\}\}$$

(d) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{1,0,2\}\} \quad \{3,\{1,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{2,1,2\}\}$$

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[127] **Answers for Set No: CXXVII**

(a) The eigenvalues are $\{-7,-2,1\}$ and the eigenvector(s) are

$$\{-7,\{0,1,0\}\} \quad \{-2,\{-1,2,1\}\} \quad \{1,\{-2,2,1\}\}$$

(b) The eigenvalues are $\{-3,-3,-1\}$ and the eigenvector(s) are

$$\{-3,\{0,-1,1\}\} \quad \{-3,\{1,0,0\}\} \quad \{-1,\{2,0,1\}\}$$

(c) The eigenvalues are $\{3,2,2\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\} \quad \{2,\{1,-1,3\}\}$$

(d) The eigenvalues are $\{-3,-3,-3\}$ and the eigenvector(s) are

$$\{-3,\{-1,0,1\}\} \quad \{-3,\{-1,1,0\}\}$$

(e) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{1,0,1\}\}$$

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[128] **Answers for Set No: CXXVIII**

(a) The eigenvalues are $\{2,1,0\}$ and the eigenvector(s) are

$$\{2,\{0,1,0\}\} \quad \{1,\{-2,3,1\}\} \quad \{0,\{-3,4,2\}\}$$

(b) The eigenvalues are $\{-3,-2,-2\}$ and the eigenvector(s) are

$$\{-3,\{-1,1,1\}\} \quad \{-2,\{-3,0,2\}\} \quad \{-2,\{0,1,0\}\}$$

(c) The eigenvalues are $\{2,2,-1\}$ and the eigenvector(s) are

$$\{2,\{1,1,0\}\} \quad \{-1,\{-2,-1,2\}\}$$

(d) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-2,0,1\}\} \quad \{-2,\{1,1,0\}\}$$

(e) The eigenvalues are $\{1,1,1\}$ and the eigenvector(s) are

$$\{1,\{0,0,1\}\}$$

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[129] **Answers for Set No: CXXIX**

(a) The eigenvalues are $\{6, 1, 0\}$ and the eigenvector(s) are

$$\{6, \{0, 1, 0\}\} \quad \{1, \{-2, 3, 1\}\} \quad \{0, \{-3, 4, 2\}\}$$

(b) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{-2, \{-1, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(c) The eigenvalues are $\{-2, -2, 1\}$ and the eigenvector(s) are

$$\{-2, \{-3, 1, 2\}\} \quad \{1, \{-1, 1, 1\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[130] **Answers for Set No: CXXX**

(a) The eigenvalues are $\{7, 1, 0\}$ and the eigenvector(s) are

$$\{7, \{0, 1, 0\}\} \quad \{1, \{-2, 3, 1\}\} \quad \{0, \{-3, 4, 2\}\}$$

(b) The eigenvalues are $\{-3, -3, -1\}$ and the eigenvector(s) are

$$\{-3, \{1, 0, 1\}\} \quad \{-3, \{0, 1, 0\}\} \quad \{-1, \{2, 1, 1\}\}$$

(c) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{-2, \{-3, -1, 2\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{0, 0, 1\}\} \quad \{-2, \{-1, 1, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[131] **Answers for Set No: CXXXI**

(a) The eigenvalues are $\{3, -2, -1\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{-2, \{-1, 1, 2\}\} \quad \{-1, \{-1, 1, 1\}\}$$

(b) The eigenvalues are $\{-3, -1, -1\}$ and the eigenvector(s) are

$$\{-3, \{2, 1, 1\}\} \quad \{-1, \{1, 0, 1\}\} \quad \{-1, \{0, 1, 0\}\}$$

(c) The eigenvalues are $\{-1, 1, 1\}$ and the eigenvector(s) are

$$\{-1, \{2, 1, 2\}\} \quad \{1, \{1, 1, 2\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 1, 1\}\} \quad \{-1, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[132] **Answers for Set No: CXXXII**

(a) The eigenvalues are $\{3, 2, -1\}$ and the eigenvector(s) are

$$\{3, \{-2, 1, 1\}\} \quad \{2, \{-1, 1, 1\}\} \quad \{-1, \{-1, 1, 0\}\}$$

(b) The eigenvalues are $\{-2, -2, -1\}$ and the eigenvector(s) are

$$\{-2, \{1, 0, 1\}\} \quad \{-2, \{-1, 2, 0\}\} \quad \{-1, \{2, -3, 1\}\}$$

(c) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 0\}\} \quad \{0, \{2, 2, 1\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[133] **Answers for Set No: CXXXIII**

(a) The eigenvalues are $\{4, 1, 0\}$ and the eigenvector(s) are

$$\{4, \{-2, 0, 1\}\} \quad \{1, \{-3, -1, 2\}\} \quad \{0, \{-2, -1, 1\}\}$$

(b) The eigenvalues are $\{-2, -1, -1\}$ and the eigenvector(s) are

$$\{-2, \{3, 1, 0\}\} \quad \{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(c) The eigenvalues are $\{2, 1, 1\}$ and the eigenvector(s) are

$$\{2, \{-1, 1, 0\}\} \quad \{1, \{1, 0, 1\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 0, 1\}\} \quad \{-1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{-3, -3, -3\}$ and the eigenvector(s) are

$$\{-3, \{-1, 2, 0\}\}$$

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[134] **Answers for Set No: CXXXIV**

(a) The eigenvalues are $\{5, -2, 1\}$ and the eigenvector(s) are

$$\{5, \{-1, -1, 1\}\} \quad \{-2, \{1, 1, 0\}\} \quad \{1, \{0, -1, 1\}\}$$

(b) The eigenvalues are $\{3, -1, -1\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\} \quad \{-1, \{1, 0, 2\}\} \quad \{-1, \{1, 1, 0\}\}$$

(c) The eigenvalues are $\{3, 3, 2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{2, \{1, 1, 0\}\}$$

(d) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{0, 1, 2\}\} \quad \{-1, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, -1, 1\}\}$$

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[135] **Answers for Set No: CXXXV**

(a) The eigenvalues are $\{5, 2, -1\}$ and the eigenvector(s) are

$$\{5, \{-1, -1, 1\}\} \quad \{2, \{0, -1, 1\}\} \quad \{-1, \{1, 1, 0\}\}$$

(b) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{-3, 0, 1\}\} \quad \{-1, \{1, 1, 0\}\} \quad \{0, \{-1, 1, 1\}\}$$

(c) The eigenvalues are $\{3, 2, 2\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\} \quad \{2, \{1, -1, 3\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\} \quad \{1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, 1, 0\}\}$$

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[136] **Answers for Set No: CXXXVI**

(a) The eigenvalues are $\{3, 2, 0\}$ and the eigenvector(s) are

$$\{3, \{-3, -1, 1\}\} \quad \{2, \{1, 1, 0\}\} \quad \{0, \{0, 1, 1\}\}$$

(b) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{0, 3, 1\}\} \quad \{-1, \{1, 0, 0\}\} \quad \{0, \{2, 2, 1\}\}$$

(c) The eigenvalues are $\{2, 2, -1\}$ and the eigenvector(s) are

$$\{2, \{1, 1, 0\}\} \quad \{-1, \{-2, -1, 2\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{2, 0, 1\}\} \quad \{1, \{0, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{2, 1, 1\}\}$$

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[137] **Answers for Set No: CXXXVII**

(a) The eigenvalues are $\{3, 2, -1\}$ and the eigenvector(s) are

$$\{3, \{3, -1, 1\}\} \quad \{2, \{2, -1, 1\}\} \quad \{-1, \{1, 0, 1\}\}$$

(b) The eigenvalues are $\{1, 1, 0\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\} \quad \{1, \{1, 1, 0\}\} \quad \{0, \{2, 1, 0\}\}$$

(c) The eigenvalues are $\{-2, -2, 1\}$ and the eigenvector(s) are

$$\{-2, \{-3, 1, 2\}\} \quad \{1, \{-1, 1, 1\}\}$$

(d) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\} \quad \{1, \{2, 1, 0\}\}$$

(e) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{2, 1, 2\}\}$$

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[138] **Answers for Set No: CXXXVIII**

(a) The eigenvalues are $\{3, 1, 0\}$ and the eigenvector(s) are

$$\{3, \{-2, 1, 1\}\} \quad \{1, \{-1, 1, 1\}\} \quad \{0, \{0, 1, 0\}\}$$

(b) The eigenvalues are $\{-3, -3, 1\}$ and the eigenvector(s) are

$$\{-3, \{0, 1, 1\}\} \quad \{-3, \{1, 0, 0\}\} \quad \{1, \{-2, 1, 0\}\}$$

(c) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 1\}\} \quad \{-2, \{-3, -1, 2\}\}$$

(d) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{0, -1, 2\}\} \quad \{2, \{1, 0, 0\}\}$$

(e) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 1\}\}$$

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[139] **Answers for Set No: CXXXIX**

(a) The eigenvalues are $\{-7, 2, -1\}$ and the eigenvector(s) are

$$\{-7, \{0, 1, 0\}\} \quad \{2, \{-2, 2, 1\}\} \quad \{-1, \{-1, 2, 1\}\}$$

(b) The eigenvalues are $\{1, 1, 0\}$ and the eigenvector(s) are

$$\{1, \{0, -1, 2\}\} \quad \{1, \{1, 0, 0\}\} \quad \{0, \{-3, -1, 1\}\}$$

(c) The eigenvalues are $\{-1, 1, 1\}$ and the eigenvector(s) are

$$\{-1, \{2, 1, 2\}\} \quad \{1, \{1, 1, 2\}\}$$

(d) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{2, 0, 1\}\} \quad \{3, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\}$$

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[140] **Answers for Set No: CXL**

(a) The eigenvalues are $\{-3, 2, -1\}$ and the eigenvector(s) are

$$\{-3, \{0, 1, 0\}\} \quad \{2, \{-2, 1, 1\}\} \quad \{-1, \{-1, 1, 1\}\}$$

(b) The eigenvalues are $\{2, 1, 1\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\} \quad \{1, \{0, 0, 1\}\} \quad \{1, \{-2, 1, 0\}\}$$

(c) The eigenvalues are $\{-1, -1, 0\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 0\}\} \quad \{0, \{2, 2, 1\}\}$$

(d) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 2\}\} \quad \{3, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{2, 2, 2\}$ and the eigenvector(s) are

$$\{2, \{-1, 0, 2\}\}$$

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[141] **Answers for Set No: CXLI**

(a) The eigenvalues are $\{3,2,0\}$ and the eigenvector(s) are

$$\{3,\{-1,0,1\}\} \quad \{2,\{-1,1,1\}\} \quad \{0,\{-1,1,2\}\}$$

(b) The eigenvalues are $\{-2,2,2\}$ and the eigenvector(s) are

$$\{-2,\{1,0,1\}\} \quad \{2,\{0,0,1\}\} \quad \{2,\{1,1,0\}\}$$

(c) The eigenvalues are $\{2,1,1\}$ and the eigenvector(s) are

$$\{2,\{-1,1,0\}\} \quad \{1,\{1,0,1\}\}$$

(d) The eigenvalues are $\{-3,-3,-3\}$ and the eigenvector(s) are

$$\{-3,\{-1,0,1\}\} \quad \{-3,\{-1,1,0\}\}$$

(e) The eigenvalues are $\{2,2,2\}$ and the eigenvector(s) are

$$\{2,\{-1,0,2\}\}$$

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[142] **Answers for Set No: CXLII**

(a) The eigenvalues are $\{2,1,0\}$ and the eigenvector(s) are

$$\{2,\{4,-3,1\}\} \quad \{1,\{5,-4,2\}\} \quad \{0,\{2,-2,1\}\}$$

(b) The eigenvalues are $\{2,2,0\}$ and the eigenvector(s) are

$$\{2,\{1,0,2\}\} \quad \{2,\{1,2,0\}\} \quad \{0,\{0,-2,1\}\}$$

(c) The eigenvalues are $\{3,3,2\}$ and the eigenvector(s) are

$$\{3,\{-1,-1,1\}\} \quad \{2,\{1,1,0\}\}$$

(d) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-2,0,1\}\} \quad \{-2,\{1,1,0\}\}$$

(e) The eigenvalues are $\{3,3,3\}$ and the eigenvector(s) are

$$\{3,\{1,0,1\}\}$$

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[143] **Answers for Set No: CXLIII**

(a) The eigenvalues are $\{3, 1, 0\}$ and the eigenvector(s) are

$$\{3, \{1, -1, 1\}\} \quad \{1, \{1, -2, 1\}\} \quad \{0, \{2, -5, 3\}\}$$

(b) The eigenvalues are $\{2, 2, 1\}$ and the eigenvector(s) are

$$\{2, \{0, 0, 1\}\} \quad \{2, \{-1, 1, 0\}\} \quad \{1, \{1, 0, 1\}\}$$

(c) The eigenvalues are $\{3, 2, 2\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\} \quad \{2, \{1, -1, 3\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{-1, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(e) The eigenvalues are $\{3, 3, 3\}$ and the eigenvector(s) are

$$\{3, \{1, 0, 1\}\}$$

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[144] **Answers for Set No: CXLIV**

(a) The eigenvalues are $\{3, 1, 0\}$ and the eigenvector(s) are

$$\{3, \{-1, 1, 0\}\} \quad \{1, \{1, -4, 2\}\} \quad \{0, \{0, -1, 1\}\}$$

(b) The eigenvalues are $\{3, 3, 2\}$ and the eigenvector(s) are

$$\{3, \{-1, 0, 3\}\} \quad \{3, \{4, 3, 0\}\} \quad \{2, \{1, 1, 0\}\}$$

(c) The eigenvalues are $\{2, 2, -1\}$ and the eigenvector(s) are

$$\{2, \{1, 1, 0\}\} \quad \{-1, \{-2, -1, 2\}\}$$

(d) The eigenvalues are $\{-2, -2, -2\}$ and the eigenvector(s) are

$$\{-2, \{0, 0, 1\}\} \quad \{-2, \{-1, 1, 0\}\}$$

(e) The eigenvalues are $\{-3, -3, -3\}$ and the eigenvector(s) are

$$\{-3, \{-1, 2, 0\}\}$$

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[145] **Answers for Set No: CXLV**

(a) The eigenvalues are $\{2,1,0\}$ and the eigenvector(s) are

$$\{2,\{2,1,1\}\} \quad \{1,\{3,2,1\}\} \quad \{0,\{5,4,2\}\}$$

(b) The eigenvalues are $\{3,3,1\}$ and the eigenvector(s) are

$$\{3,\{0,-1,1\}\} \quad \{3,\{1,0,0\}\} \quad \{1,\{1,0,1\}\}$$

(c) The eigenvalues are $\{-2,-2,1\}$ and the eigenvector(s) are

$$\{-2,\{-3,1,2\}\} \quad \{1,\{-1,1,1\}\}$$

(d) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{0,1,1\}\} \quad \{-1,\{1,0,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-1,-1,1\}\}$$

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[146] **Answers for Set No: CXLVI**

(a) The eigenvalues are $\{2,-1,0\}$ and the eigenvector(s) are

$$\{2,\{3,3,2\}\} \quad \{-1,\{0,1,0\}\} \quad \{0,\{1,1,1\}\}$$

(b) The eigenvalues are $\{3,3,1\}$ and the eigenvector(s) are

$$\{3,\{-1,0,1\}\} \quad \{3,\{0,1,0\}\} \quad \{1,\{-1,-1,2\}\}$$

(c) The eigenvalues are $\{3,-2,-2\}$ and the eigenvector(s) are

$$\{3,\{-1,0,1\}\} \quad \{-2,\{-3,-1,2\}\}$$

(d) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{0,0,1\}\} \quad \{-1,\{2,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{-1,1,0\}\}$$

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[147] **Answers for Set No: CXLVII**

(a) The eigenvalues are $\{4,3,1\}$ and the eigenvector(s) are

$$\{4,\{-1,-1,2\}\} \quad \{3,\{-1,-3,3\}\} \quad \{1,\{0,1,0\}\}$$

(b) The eigenvalues are $\{3,3,2\}$ and the eigenvector(s) are

$$\{3,\{0,0,1\}\} \quad \{3,\{-1,2,0\}\} \quad \{2,\{-1,1,2\}\}$$

(c) The eigenvalues are $\{-1,1,1\}$ and the eigenvector(s) are

$$\{-1,\{2,1,2\}\} \quad \{1,\{1,1,2\}\}$$

(d) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{0,0,1\}\} \quad \{-1,\{2,1,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{2,1,1\}\}$$

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[148] **Answers for Set No: CXLVIII**

(a) The eigenvalues are $\{3,2,0\}$ and the eigenvector(s) are

$$\{3,\{4,-2,1\}\} \quad \{2,\{3,-2,1\}\} \quad \{0,\{-1,1,0\}\}$$

(b) The eigenvalues are $\{-3,-3,-1\}$ and the eigenvector(s) are

$$\{-3,\{0,-1,1\}\} \quad \{-3,\{1,0,0\}\} \quad \{-1,\{2,0,1\}\}$$

(c) The eigenvalues are $\{-1,-1,0\}$ and the eigenvector(s) are

$$\{-1,\{1,0,0\}\} \quad \{0,\{2,2,1\}\}$$

(d) The eigenvalues are $\{-1,-1,-1\}$ and the eigenvector(s) are

$$\{-1,\{0,1,2\}\} \quad \{-1,\{1,0,0\}\}$$

(e) The eigenvalues are $\{-2,-2,-2\}$ and the eigenvector(s) are

$$\{-2,\{2,1,2\}\}$$

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[149] **Answers for Set No: CXLIX**

(*a*) The eigenvalues are $\{7, 1, 0\}$ and the eigenvector(s) are

$$\{7, \{-1, -1, 1\}\} \quad \{1, \{0, -1, 1\}\} \quad \{0, \{1, 1, 0\}\}$$

(*b*) The eigenvalues are $\{-3, -2, -2\}$ and the eigenvector(s) are

$$\{-3, \{-1, 1, 1\}\} \quad \{-2, \{-3, 0, 2\}\} \quad \{-2, \{0, 1, 0\}\}$$

(*c*) The eigenvalues are $\{2, 1, 1\}$ and the eigenvector(s) are

$$\{2, \{-1, 1, 0\}\} \quad \{1, \{1, 0, 1\}\}$$

(*d*) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\} \quad \{1, \{2, 1, 0\}\}$$

(*e*) The eigenvalues are $\{-1, -1, -1\}$ and the eigenvector(s) are

$$\{-1, \{1, 0, 1\}\}$$

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[150] **Answers for Set No: CL**

(*a*) The eigenvalues are $\{3, -2, 1\}$ and the eigenvector(s) are

$$\{3, \{-3, -1, 1\}\} \quad \{-2, \{0, 1, 1\}\} \quad \{1, \{1, 1, 0\}\}$$

(*b*) The eigenvalues are $\{3, -2, -2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{-2, \{-1, 0, 1\}\} \quad \{-2, \{1, 1, 0\}\}$$

(*c*) The eigenvalues are $\{3, 3, 2\}$ and the eigenvector(s) are

$$\{3, \{-1, -1, 1\}\} \quad \{2, \{1, 1, 0\}\}$$

(*d*) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{2, 0, 1\}\} \quad \{1, \{0, 1, 0\}\}$$

(*e*) The eigenvalues are $\{1, 1, 1\}$ and the eigenvector(s) are

$$\{1, \{0, 0, 1\}\}$$

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