

ANSWERS (01):

(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

$$\{-3, \{-1, 2, 0\}\}$$

ANSWERS (02):

(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

$$\{-2, \{-1, -1, 1\}\}$$

ANSWERS (03):

(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

$$\{-2, \{-1, 1, 0\}\}$$

ANSWERS (04):

(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

$$\{-2, \{2, 1, 1\}\}$$

ANSWERS (05):

(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

$$\{-2, \{2, 1, 2\}\}$$

ANSWERS (06):

(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

$$\{-1, \{1, 0, 1\}\}$$

ANSWERS (07):

(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

$$\{1, \{0, 0, 1\}\}$$

ANSWERS (08):

(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

$$\{2, \{-1, 0, 2\}\}$$

ANSWERS (09):

(a) The eigenvalues are $\{3, -1, 0\}$ and the eigenvector(s) are

$$\{3, \{1, -1, 1\}\} \quad \{-1, \{-1, 1, 0\}\} \quad \{0, \{-1, 2, 1\}\}$$

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(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

$$\{2, \{-1, 0, 2\}\}$$

ANSWERS (10):

(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

$$\{3, \{1, 0, 1\}\}$$

ANSWERS (11):

(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

$$\{3, \{1, 0, 1\}\}$$

ANSWERS (12):

(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

$$\{-3, \{-1, 2, 0\}\}$$

ANSWERS (13):

(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

$$\{-2, \{-1, -1, 1\}\}$$

ANSWERS (14):

(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

$$\{-2, \{-1, 1, 0\}\}$$

ANSWERS (15):

(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

$$\{-2, \{2, 1, 1\}\}$$

ANSWERS (16):

(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

$$\{-2, \{2, 1, 2\}\}$$

ANSWERS (17):

(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

$$\{-1, \{1, 0, 1\}\}$$

ANSWERS (18):

(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

$$\{1, \{0, 0, 1\}\}$$

ANSWERS (19):

(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

$$\{2, \{-1, 0, 2\}\}$$

ANSWERS (20):

(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

$$\{2, \{-1, 0, 2\}\}$$

ANSWERS (21):

(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

$$\{3, \{1, 0, 1\}\}$$

ANSWERS (22):

(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

$$\{3, \{1, 0, 1\}\}$$

ANSWERS (23):

(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

$$\{-3, \{-1, 2, 0\}\}$$

ANSWERS (24):

(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

$$\{-2, \{-1, -1, 1\}\}$$

ANSWERS (25):

(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

$$\{-2, \{-1, 1, 0\}\}$$

ANSWERS (26):

(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

$$\{-2, \{2, 1, 1\}\}$$

ANSWERS (27):

(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

$$\{-2, \{2, 1, 2\}\}$$

ANSWERS (28):

(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

$$\{-1, \{1, 0, 1\}\}$$

ANSWERS (29):

(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

$$\{1, \{0, 0, 1\}\}$$

ANSWERS (30):

(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

$$\{2, \{-1, 0, 2\}\}$$

ANSWERS (31):

(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

$$\{2, \{-1, 0, 2\}\}$$

ANSWERS (32):

(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

$$\{3, \{1, 0, 1\}\}$$

ANSWERS (33):

(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

$$\{3, \{1, 0, 1\}\}$$

ANSWERS (34):

(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

$$\{-3, \{-1, 2, 0\}\}$$

ANSWERS (35):

(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

$$\{-2, \{-1, -1, 1\}\}$$

ANSWERS (36):

(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

$$\{-2, \{-1, 1, 0\}\}$$

ANSWERS (37):

(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

$$\{-2, \{2, 1, 1\}\}$$

ANSWERS (38):

(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

$$\{-2, \{2, 1, 2\}\}$$

ANSWERS (39):

(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

$$\{-1, \{1, 0, 1\}\}$$

ANSWERS (40):

(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

$$\{1, \{0, 0, 1\}\}$$

ANSWERS (41):

(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

$$\{2, \{-1, 0, 2\}\}$$

ANSWERS (42):

(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

$$\{2, \{-1, 0, 2\}\}$$

ANSWERS (43):

(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

$$\{3, \{1, 0, 1\}\}$$

ANSWERS (44):

(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

$$\{3, \{1, 0, 1\}\}$$

ANSWERS (45):

(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

$$\{-3, \{-1, 2, 0\}\}$$

ANSWERS (46):

(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

$$\{-2, \{-1, -1, 1\}\}$$

ANSWERS (47):

(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

$$\{-2, \{-1, 1, 0\}\}$$

ANSWERS (48):

(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

$$\{-2, \{2, 1, 1\}\}$$

ANSWERS (49):

(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

$$\{-2, \{2, 1, 2\}\}$$

ANSWERS (50):

(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

$$\{-1, \{1, 0, 1\}\}$$

ANSWERS (51):

(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

$$\{1, \{0, 0, 1\}\}$$

ANSWERS (52):

(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

$$\{2, \{-1, 0, 2\}\}$$

ANSWERS (52):

(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

$$\{2, \{-1, 0, 2\}\}$$

ANSWERS (54):

(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

$$\{3, \{1, 0, 1\}\}$$

ANSWERS (55):

(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

$$\{3, \{1, 0, 1\}\}$$

ANSWERS (56):

(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

$$\{-3, \{-1, 2, 0\}\}$$

ANSWERS (57):

(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

$$\{-2, \{-1, -1, 1\}\}$$

ANSWERS (58):

(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

$$\{-2, \{-1, 1, 0\}\}$$

ANSWERS (59):

(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

$$\{-2, \{2, 1, 1\}\}$$

ANSWERS (60):

(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

$$\{-2, \{2, 1, 2\}\}$$

ANSWERS (61):

(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

$$\{-1, \{1, 0, 1\}\}$$

ANSWERS (62):

(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

$$\{1, \{0, 0, 1\}\}$$

ANSWERS (63):

(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

$$\{2, \{-1, 0, 2\}\}$$

ANSWERS (64):

(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

$$\{2, \{-1, 0, 2\}\}$$

ANSWERS (65):

(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

$$\{3, \{1, 0, 1\}\}$$