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Chapter 2 Matrices

Answers to Odd Numbered Homework Problems at end of sections
and

Answers to all problems in Chapter Review Section

2.1 Introduction to Matrices

$$1) \begin{bmatrix} 18 & 15 \\ 14 & 13 \\ 12 & 9 \end{bmatrix} \quad 3) \begin{bmatrix} 84 \\ 68 \\ 54 \end{bmatrix} \quad 5) [112.2]$$

$$7) AB = \begin{bmatrix} 12 & 22 & 19 \\ 10 & 7 & 5 \\ 9 & 15 & 13 \end{bmatrix} \quad 9) AB + BA = \begin{bmatrix} 19 & 35 & 19 \\ 17 & 25 & 20 \\ 20 & 38 & 20 \end{bmatrix}$$

$$11) 2BC = \begin{bmatrix} 10 \\ 30 \\ 16 \end{bmatrix} \quad 13) A^2B = \begin{bmatrix} 105 & 123 & 100 \\ 37 & 52 & 44 \\ 73 & 87 & 71 \end{bmatrix}$$

$$15) FE = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} m & n \\ p & q \end{bmatrix} = \begin{bmatrix} am+bp & an+bq \\ cm+dp & cn+dq \end{bmatrix}$$

17) H is a 3×1 matrix. G is a 3×3 matrix.

HG does not exist because the number of columns in H does not equal the number of rows in G.

$$19) \begin{bmatrix} 1 & -2 & 2 \\ 1 & -3 & 4 \\ 1 & -2 & -3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 \\ 7 \\ -12 \end{bmatrix}$$

$$21) \begin{bmatrix} 1 & 2 & 3 & 2 \\ 1 & -2 & -1 & 0 \\ 0 & 1 & -2 & 4 \\ 1 & 0 & 3 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ w \end{bmatrix} = \begin{bmatrix} 14 \\ -5 \\ 9 \\ 15 \end{bmatrix} \quad \text{OR} \quad \begin{bmatrix} 2 & 1 & 2 & 3 \\ 0 & 1 & -2 & -1 \\ 4 & 0 & 1 & -2 \\ 3 & 1 & 0 & 3 \end{bmatrix} \begin{bmatrix} w \\ x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 14 \\ -5 \\ 9 \\ 15 \end{bmatrix}$$

2.2 System of Linear Equations; Gauss-Jordan Method

- 1). $(4, -1)$
- 3). $(2, -1, 3)$
- 5). $(0.4, 0.3)$
- 7). $(4, 3, 2, 1)$

2.3 System of Linear Equations; Gauss – Special Cases

- 1). $(4 - 3t, t)$
- 3). Inconsistent system, no solution
- 5). $(3 - 4/7 t, -1 + 16/7 t, t)$
- 7). No, they are not consistent.
- 9). $(5, 3, 1), (4, 3, 2), (3, 3, 3)$
- 11). $(5 - 3s + t, s, t)$

2.4 Inverse Matrices

- 3). $\begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$
- 5). $\begin{bmatrix} 1 & 2 & -1 \\ -1 & -3 & 2 \\ -1 & -1 & 1 \end{bmatrix}$
- 7). $(4, 2)$
- 9). $(3, 3, 4)$

- 11). If a matrix M has an inverse, then the system of linear equations that has M as its coefficient matrix has a unique solution. If a system of linear equations has a unique solution, then the number of equations must be the same as the number of variables. Therefore, the matrix that represent its coefficient matrix must be a square matrix.

2.5 Application of Matrices in Cryptography

- 1). $\begin{bmatrix} 71 \\ 24 \end{bmatrix} \begin{bmatrix} 66 \\ 23 \end{bmatrix} \begin{bmatrix} 78 \\ 35 \end{bmatrix} \begin{bmatrix} 87 \\ 36 \end{bmatrix} \begin{bmatrix} 114 \\ 47 \end{bmatrix}$
- 3). RETURN HOME
- 5). $\begin{bmatrix} 12 \\ 51 \\ 9 \end{bmatrix} \begin{bmatrix} 11 \\ 67 \\ 2 \end{bmatrix} \begin{bmatrix} 19 \\ 95 \\ 14 \end{bmatrix} \begin{bmatrix} 14 \\ 105 \\ -11 \end{bmatrix} \begin{bmatrix} 15 \\ 87 \\ -3 \end{bmatrix} \begin{bmatrix} 27 \\ 91 \\ 18 \end{bmatrix} \begin{bmatrix} 4 \\ 67 \\ -23 \end{bmatrix}$
- 7). HEAD FOR THE HILLS

2.6 Applications – Leontief Models

- 1). $(t, -2t, t)$ 3). Chris = \$1250, Ed = \$1,000
- 5). $\begin{bmatrix} 315.34 \\ 383.52 \\ 440.34 \end{bmatrix}$
- 7). Farming = \$201,754.38, Building = \$307,017.54
- 9). $\begin{bmatrix} 30/100 & 10/120 & 20/110 \\ 20/100 & 30/120 & 20/110 \\ 10/100 & 10/120 & 30/110 \end{bmatrix}$

2.7 Chapter Review

- 1). a. $\begin{bmatrix} 1000 & 400 & 15 \\ 800 & 500 & 20 \end{bmatrix}$ b. $\begin{bmatrix} 30 & 50 \end{bmatrix}$
- 2). a. $\begin{bmatrix} 2 & 1 & 1 \\ 2 & 1 & -1 \end{bmatrix}$ b. $\begin{bmatrix} -3 & -9 & 11 \\ 7 & -14 & 9 \end{bmatrix}$
- 3). a. $\begin{bmatrix} -2 & 8 & 0 \\ -2 & 4 & 6 \\ -4 & 6 & 6 \end{bmatrix}$ b. $\begin{bmatrix} -5 & 10 & 2 \\ -7 & 4 & 7 \\ -8 & 9 & 7 \end{bmatrix}$
- 4). a. $\begin{bmatrix} 2 & -2 & 4 \\ 14 & 16 & -22 \\ 8 & 10 & -14 \end{bmatrix}$ b. $\begin{bmatrix} 9 & -3 \\ 6 & -3 \end{bmatrix}$
- 5). a. $\begin{bmatrix} 2a-2c+6e & 2b-2d+6f \\ 6a+4c+2e & 6b+4d+2f \end{bmatrix}$ b. $\begin{bmatrix} a+3b & -a+2b & 3a+b \\ c+3d & -c+2d & 3c+d \\ e+3f & -e+2f & 3e+f \end{bmatrix}$
- 6). a. $(2, 1, -1)$ b. $(3, 2, 1)$
- 7). Apple = \$.50; banana = \$.30; orange = \$.40
- 8). a. $x = 6 - t, y = 0, z = t; (5, 0, 1)$ b. no solution

9). $n = 3t - 12$, $d = -4t + 24$, $q = t$; $n = 3$, $d = 4$, $q = 5$

10). a. $x = 4 - 2t$, $y = t$, $z = 3$; $(4, 0, 3)$ b. $x = 5 - 4t$, $y = 2 - t$, $z = t$; $(1, 1, 1)$

11). a. $x = .5t$, $y = t$, $z = 2t$; $(1, 2, 2)$ b. no solution

12). a. $\begin{bmatrix} 5 & -3 \\ -3 & 2 \end{bmatrix}$ b. $\begin{bmatrix} 1 & -2 & 1 \\ -1 & 1 & 0 \\ 1 & 1 & -1 \end{bmatrix}$

13). a. $(-1, 4, 2)$ b. $(6, 4, 2, -1)$

14). a. $\begin{bmatrix} 22 \\ 33 \\ 1 \end{bmatrix} \begin{bmatrix} 59 \\ 68 \\ 27 \end{bmatrix} \begin{bmatrix} 74 \\ 75 \\ 27 \end{bmatrix} \begin{bmatrix} 22 \\ 49 \\ 4 \end{bmatrix} \begin{bmatrix} 60 \\ 74 \\ 21 \end{bmatrix}$ b. $\begin{bmatrix} 17 \\ 37 \\ 5 \end{bmatrix} \begin{bmatrix} 57 \\ 78 \\ 15 \end{bmatrix} \begin{bmatrix} 74 \\ 91 \\ 27 \end{bmatrix} \begin{bmatrix} 39 \\ 42 \\ 9 \end{bmatrix} \begin{bmatrix} 65 \\ 92 \\ 27 \end{bmatrix}$

15). a. NO PAIN NO GAIN b. GO FOR THE GOLD

16). $x = 40/33$ t, $y = 36/33$ t, $z = t$; Chris = 40 hrs, Bob = 36 hrs, Matt = 33 hrs

17). Chris = 34.1 hrs, Bob = 32.2 hrs, Matt = 35.2 hrs