Penney, Linear Algebra: Ideas and Applications (4th edition)

Section 1.3 EXERCISES

p. 63: 1.65(a,c,e,g,i), 1.67, 1.69, 1.78, 1.79, 1.80;

p. 73: 1.90.

Additional Problems:

#1. For the following systems (given by the augmented matrices), determine the values of a, b, c such that the systems have a (i) unique solution, (ii) infinitely many solutions, and (iii) no solution.

$$\left(\begin{array}{ccc|c} 1 & 1 & 3 & 2 \\ 1 & 2 & 4 & 3 \\ 1 & 3 & a & b \end{array} \right), \quad \left(\begin{array}{ccc|c} 1 & 1 & 1 & 2 \\ 1 & 2 & 1 & 3 \\ 1 & 1 & c^2 - 5 & c \end{array} \right),$$

For cases (i) and (ii), find the solutions explicitly.

#2. (This is based on the Leontief economic model.) Consider the three basic sectors of an economy: primary (**A**griculature), secondary (**M**achinery) and tertiary (**S**ervice). We have the following information from historical data:

  (a) To produce 1 unit of A, we need 0.1 unit of A, 0.2 unit of M, and 0.1 unit of S;

  (b) To produce 1 unit of M, we need 0.1 unit of A, 0.3 unit of M, and 0.2 unit of S;

  (c) To produce 1 unit of S, we need 0.2 unit of A, 0.1 unit of M, and 0.3 unit of S;

Suppose the annual consumer demand from the economy is 30 units of A, 40 units of M, and 50 units of S.

Determine the actual annual production level of A, M, and S.