Problem §8.6 - 3: How many solutions does the equation $x_1 + x_2 + x_3 = 13$ have where x_1, x_2, and x_3 are nonnegative integers less than 6?

Problem §8.6 - 10: In how many ways can eight distinct balls be distributed into three distinct urns if each urn must contain at least one ball?

Problem §8.6 - 14: What is the probability that none of 10 people receives the correct hat if a hatcheck person hands their hats back randomly?

Problem §9.1 - 6(a-f): Determine whether the relation R on the set of all real number is reflexive, symmetric, antisymmetric, and/or transitive, where $(x, y) \in R$ if and only if

(a) $x + y = 0$.

(b) $x = \pm y$.

(c) $x - y$ is a rational number.

(d) $x = 2y$.

(e) $xy \geq 0$.

(f) $xy = 0$.

Problem §9.1 - 15: Can a relation on a set be neither reflexive nor irreflexive?

Problem §9.1 - 22: Must an asymmetric relation also be antisymmetric? Must an antisymmetric relation also be asymmetric?

Problem §9.1 - 26: Let R be the relation $R = \{(a, b) : a < b\}$ on the set of integers. Find

(a) R^{-1}.

(b) $\overline{R}$.

Problem §9.3 - 2(a,b): Represent each of these relations on $\{1, 2, 3, 4\}$ with a matrix (with the elements of this set listed in increasing order).

(a) $\{(1,2),\ (1,3),\ (1,4)\ ,(2,3),\ (2,4),\ (3,4)\}$

(b) $\{(1,1),\ (1,4),\ (2,2),\ (3,3),\ (4,1)\}$

Problem §9.3 - 14(a-d): Let R_1 and R_2 be relations on a set A represented by the matrices

$$M_{R_1} = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix} \qquad \text{and} \qquad M_{R_2} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

Find the matrices that represent

(a) $R_1 \cup R_2$.

(b) $R_1 \cap R_2$.

(c) $R_2 \circ R_1$.

(d) $R_1 \circ R_1$.

Problem §9.3 - 22: Draw the directed graph that represents the relation

$$\{(a,a),\ (a,b),\ (b,c),\ (c,b),\ (c,d),\ (d,a),\ (d,b)\}.$$

Problem §9.3 - 26: List the ordered pairs in the relations represented by the directed graph