

**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 hatcher 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)  $\bar{R}$ .

**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

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

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

