9.3 Representing Relations

9.3 pg. 596 # 1

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

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

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

c $\{(1, 1), (1, 2), (1, 3), (2, 2), (2, 3), (3, 3)\}$

d $\{(1, 3), (3, 1)\}$

9.3 pg. 596 # 3

List the ordered pairs in the relations on $\{1, 2, 3\}$ corresponding to these matrices (where the rows and columns correspond to the integers listed in increasing order).

a $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$

b $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \end{bmatrix}$

c $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{bmatrix}$

9.3 pg. 596 # 9

How many nonzero entries does the matrix representing the relation R on $A = \{1, 2, 3, \ldots, 100\}$ consisting of the first 100 positive integers if R is

a $\{(a, b)|a > b\}$?

b $\{(a, b)|a \neq b\}$?

c $\{(a, b)|a = b + 1\}$?

d $\{(a, b)|a = 1\}$?

e $\{(a, b)|ab = 1\}$?

9.3 pg. 596 # 13

Let R be the relation represented by the matrix

$$M_R = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$$

Find the matrix representing

a R^{-1}

b $\overline{R}$

c R^2

9.3 pg. 597 # 19

Draw the directed graphs representing each of the relations

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

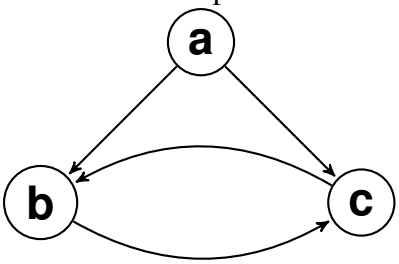
b $\{(1,1),(1,4),(2,2),(3,3),(4,1)\}$

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

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

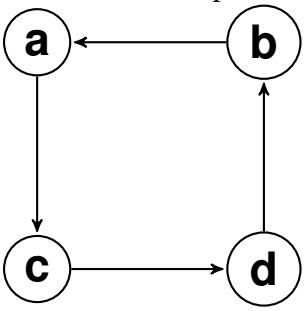
9.3 pg. 597 # 23

List the ordered pairs in the relations represented by the directed graph.



9.3 pg. 597 # 25

List the ordered pairs in the relations represented by the directed graph.



9.3 pg. 597 # 31

Determine whether the relation represented by the digraph shown in Exercises 23 and 25 are reflexive, irreflexive, symmetric, antisymmetric, and/or transitive.