

8-2 Ex.2

Which 4-tuples are in the relation $\{(a, b, c, d) | a, b, c, \text{ and } d \text{ are positive integers with } abcd = 6\}$?

8-3 Ex.8

Determine whether the relations represented by the matrices are reflexive, symmetric, anti-symmetric, and/or transitive.

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

8-3 Ex.14

Let R_1 and R_2 be relations on a set A represented by the matrices

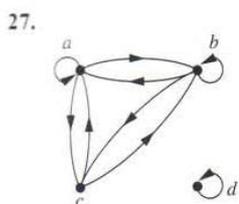
$$M_{R_1} = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix} \text{ and } M_{R_2} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}.$$

Find the matrices that represent

- c) $R_2 \circ R_1$
- d) $R_1 \circ R_1$

8-3 Ex.32

Determine whether the relations represented by the directed graphs are reflexive, symmetric, anti-symmetric, and/or transitive.



8-4 Ex.22

Suppose that the relation R is reflexive. Show that R^+ is reflexive.

8-4 Ex.26

Find the transitive closures of the relation on $\{a, b, c, d, e\}$.

a) $R = \{(a, c), (b, d), (c, a), (d, b), (e, d)\}$

8-5 Ex.9

Suppose that A is a nonempty set, and f is a function that has A as its domain.

Let R be the relation on A consisting of all ordered pairs (x, y) such that $f(x) = f(y)$.

- a) Show that R is an equivalence relation on A .
- b) What are the equivalence classes of an integer c .

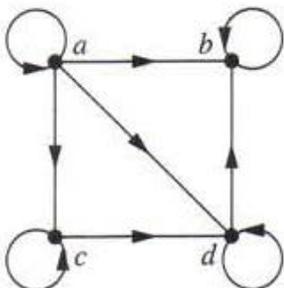
8-5 Ex.6 -c)

Suppose that R_1 and R_2 are equivalence relations on the set S .

Determine whether $R_1 \oplus R_2$ must be an equivalence relation.

8-6 Ex.10

Determine whether the relation is a partial order.



8-6 Ex.22

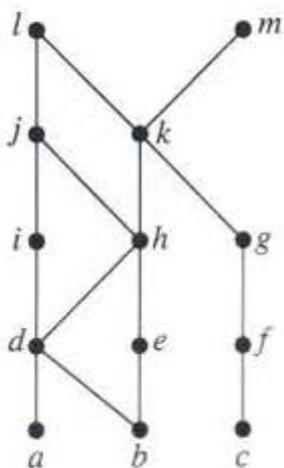
Draw the Hasse diagram for divisibility on the set

- a) $\{1,2,3,4,5,6\}$
- b) $\{3,5,7,11,13,16,17\}$
- c) $\{2,3,5,10,11,15,25\}$
- d) $\{1,3,9,27,81,243\}$

8-6 Ex.32

Answer these questions for the partial order represented by this Hasse diagram

- a) Find the maximal elements
- b) Find the minimal elements
- c) Is there a greatest element?
- d) Is there a least element?
- e) Find all upper bounds of $\{a, b, c\}$
- f) Find the least upper bound of $\{a, b, c\}$, if exists
- g) Find all lower bound of $\{f, g, h\}$
- h) Find the greatest lower bound of $\{f, g, h\}$, if exists



8-6 Ex.44

Determine whether these posets are lattices

- a) $(\{1,3,6,9,12\}, |)$
- b) $(\{1,5,25,125\}, |)$
- c) (\mathbf{Z}, \geq)
- d) $(P(S), \supseteq)$, where $P(S)$ is the power set of a set S