Discrete Mathematics — Tutorial Sheet 04 — Relations

BSc (H) in App Comp, Ent Sys, Comp Foren, and the IoT

Into/Onto and One-to-One

See questions in notes.

Question 1

For each of the following relations R defined on set $A = \{1, 2, 3, \ldots\}$, determine which of the given ordered pairs belong to R

(a) $(x, y) \in R$ iff $x|y$; (2, 3), (2, 4), (2, 8), (2, 17)

(b) $(x, y) \in R$ iff $x \leq y$; (2, 3), (3, 2), (2, 4), (5, 8)

(c) $(x, y) \in R$ iff $y = x^2$; (1,1), (2, 3), (2, 4), (2, 6)

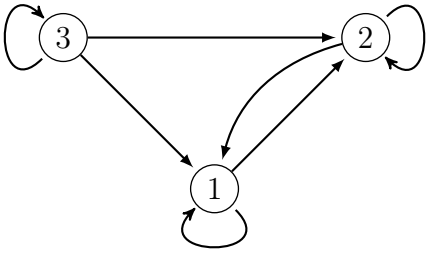
Properties of Relation on a Set

Question 2

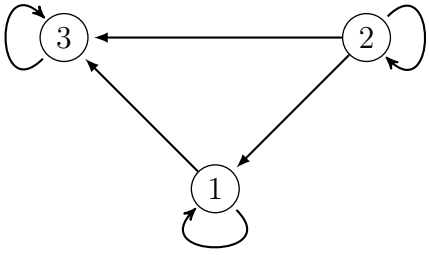
Consider the relations represented in the following graphs.

- Determine whether the given relations are reflexive, symmetric, antisymmetric, or transitive.
- Determine which relations are asymmetric, irreflexive.
- Which of the graphs are of equivalence relations?
- Construct the transitive closure of each relation.

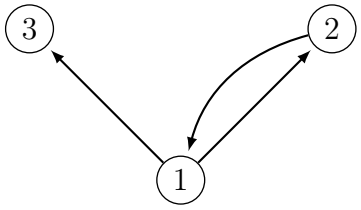
(a)



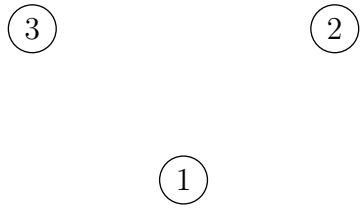
(b)



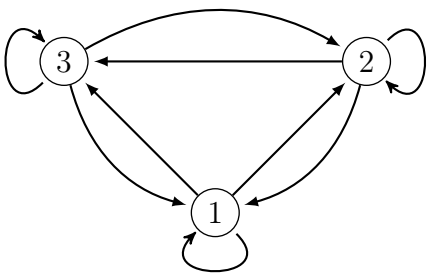
(c)



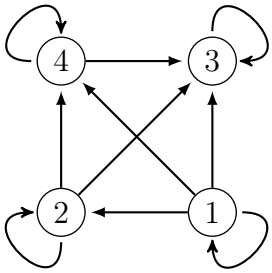
(d)



(e)



(f)



Question 3

Consider the relation on $\{1, 2, 3, 4, 5, 6\}$ defined by $R = \{(i, j) :| \ i - j \ |= 2\}$.

(a) Is R reflexive?

(b) Is R symmetric?

(c) Is R transitive?

(d) Draw a digraph of R.

Question 4

Determine which of the following are equivalence relations for the given sets:

(a) $A = \{\text{lines in the plane}\}$, and R defined by $(x, y) \in R$ if and only if x is parallel to y.

(b) $A = \mathbb{R}$ and relation R defined by $(x, y) \in R$ if and only if $|x - y| \leq 7$.