Worksheet 13

CS 2210 Discrete Structures

Due 4/30 9pm. Late submissions get grade 0.

* Teams of 3-4 students (must work in group). Follow direction given during discussion.
** This page is double sided. Make sure to do both sides. Show your work!

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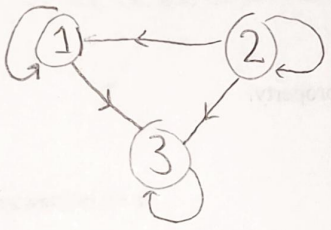
Question 1: Represent relation using matrix and using digraph. Decide if the relation is equivalence relation and/or partial order. Explain your answers.

a. $R = \{(1,1), (1,3), (2,1), (2,2), (2,3), (3,3)\}$ on set $S = \{1,2,3\}$.

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



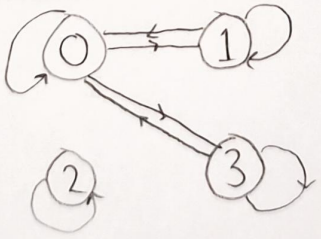
Reflexive: yes
Symmetric: no
anti-symmetric: yes
transitive: yes

not equivalence because it's not symmetric

yes, partial order because reflexic, anti-symmetric and transitive

b. R = $\{(0,0), (0,1), (0,3), (1,0), (1,1), (2,2), (3,0), (3,3)\}$ on set $S = \{0,1,2,3\}$.

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



Reflexive
Symmetric
not transitive

not equivalence because not transitive

not partial order because symmetric and not transitive

Question 2: Let R = {(1,2), (1,3), (2,3)} on set S={1, 2, 3}.

a. Find closure of R with reflexive property.

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

b. Find closure of R with symmetric property.

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

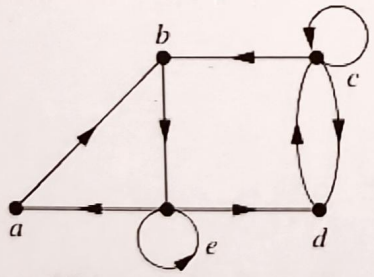
c. Find closure of R with antisymmetric property.

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

d. Find closure of R with transitive property.

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

Question 3: For the graph:



a. Find in-degree and out-degree for each vertex.

$deg^-(a) = 1$ $deg^-(d) = 2$ $deg^+(a) = 1$ $deg^+(d) = 1$

$deg^-(b) = 2$ $deg^-(e) = 2$ $deg^+(b) = 1$ $deg^+(e) = 3$

$deg^-(c) = 2$ $deg^+(c) = 3$

b. Is there a path from a to d? If yes, what is the path and what is the length of the path?

Yes (a, b)(b, e)(e, d) length 3

c. Is there a path from e to b. If yes, what is the path and what is the length of the path?

Yes (e, a) (a, b) length 2

d. Find the connectivity relation for above graph.

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

e. Find the adjacency matrix representation for G.

	a	b	c	d	e
a	0	1	0	0	0
b	0	0	0	0	1
c	0	1	1	1	0
d	0	0	1	0	0
e	1	0	0	1	1

f. Find the adjacency list representation for G.

a	b
b	e
c	c, d, b
d	c
e	e, a, b