PHILADELPHIA UNIVERSITY
DEPARTMENT OF BASIC SCIENCES

Second Exam A **DISCRETE STRUCTURES** **29–12–2009**

Part 1 Each problem is worth 2 points. Circle one answer.

1) $R = \{(1,3), (2,1), (3,4), (4,3)\}$. Find R^3.
a) $\{(1,4), (2,3), (3,3), (4,4)\}$ b) $\{(1,3), (2,4), (3,4), (4,3)\}$
c) $\{(1,4), (2,3), (3,2), (4,1)\}$ d) $\{(1,2), (2,4), (3,1), (4,3)\}$

2) Which relation is an equivalence relation?
a) $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$ b) $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}$ c) $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$ d) $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$

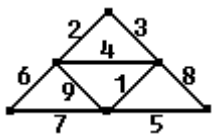
3) Given the incidence matrix $\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$ Find the adjacency matrix.

a) $\begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 2 & 0 \\ 1 & 2 & 1 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$ b) $\begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 2 & 0 \\ 0 & 2 & 1 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$ c) $\begin{bmatrix} 0 & 0 & 2 & 0 \\ 0 & 0 & 1 & 0 \\ 2 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$ d) $\begin{bmatrix} 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 1 \\ 2 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$

4) A complete graph has degree 182. How many points?
a) 13 b) 14 c) 15 d) 16

5) Which graph is an Euler circuit?
a) K6 b) K4,2 c) K2,5 d) K4

6) What is the value of the minimal spanning tree?
a) 17 b) 18 c) 19 d) 20



Part 2 Each problem is worth 4 points. Write complete solution.

7) A = {1, 2, 3, 4}. Find an example of a relation,
a) reflexive (T); symmetric (T); anti-symmetric (F); transitive (F)
b) reflexive (F); symmetric (T); anti-symmetric (F); transitive (T)

8) A = {2, 4, 6, 24, 36} and $R = \{(a,b) \mid b \bmod a = 0\}$.
a) Find R and draw digraph.
b) Prove R is partial order and draw Hasse diagram.

--Amin Witno