PHILADELPHIA UNIVERSITY
DEPARTMENT OF BASIC SCIENCES

Second Exam A **DISCRETE STRUCTURES** **21–12–2010**

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

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

2) Given A = {1,2,3,4} and R = { (a,b) | a + b < 6 }. Which one is correct?
a) reflexive (T); symmetric (F); anti-symmetric (T); transitive (F)
b) reflexive (T); symmetric (F); anti-symmetric (T); transitive (T)
c) reflexive (F); symmetric (T); anti-symmetric (F); transitive (F)
d) reflexive (F); symmetric (T); anti-symmetric (F); transitive (T)

3) Given A = {1, 2, 3} and R = { (a,b) | (a + b) mod 2 = 0 }. Find the matrix.
a) $\begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ b) $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$ c) $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}$ d) $\begin{bmatrix} 1 & 1 & 0 \\ 1 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$

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

5) How many permutations with A, B, C, D, E, F which do **not** contain "BAD"?
a) 714 b) 696 c) 120 d) 30

6) Given |A| = 8. How many subsets have at least 6 elements?
a) 72 b) 56 c) 46 d) 37

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

7) Given the matrix for a relation R = $\begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$ Find the transitive closure.

8) Let A = { 2, 4, 8, 12, 24 } and R = { (a,b) | b mod a = 0 }
a) Find the elements of R.
b) Draw the digraph.
c) Prove that R is a partial order relation.
d) Draw the Hasse diagram.

-Amin Witno