PHILADELPHIA UNIVERSITY
DEPARTMENT OF BASIC SCIENCES

Second Exam A **DISCRETE STRUCTURES** **29–04–2014**

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

1) The sequence 5, 6, 9, 14, 21, 30, ... is given which function?

a) $S(n) = 4n + 5$ b) $S(n) = n^2 + 5$
c) $S(n) = 5n + 4$ d) $S(n) = 2^n + 4$

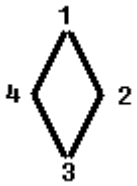
2) Which relation has transitive (T) and anti-symmetric (F) ?

a) { (1, 3), (3, 1), (1, 1), (4, 4) }
b) { (1, 3), (2, 1), (2, 3), (4, 4) }
c) { (1, 3), (2, 3), (2, 4), (3, 4) }
d) { (1, 3), (3, 1), (1, 1), (3, 3) }

3) Let A = {1, 3, 4, 9, 11, 12} and R = { (a,b) | a mod 3 = b mod 3} is an equivalence relation on A. Find the equivalence classes.

a) {1, 4}, {3, 9, 12}, {11} b) {1, 3, 9, 11}, {4, 12}
c) {1, 9}, {3, 11}, {4, 12} d) {1, 11}, {3}, {4, 9}, {12}

4) Change the Hasse diagram to matrix.



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

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

5) Find the formula for the recursive sequence $S(n) = 2\,S(n-1) + 8\,S(n-2)$ given that $S(0) = 1$ and $S(1) = 2$.

6) Prove the formula for all integers $n \geq 1$ using induction.

$$1 + 5 + 25 + \ldots + 5^{n-1} = \frac{5^n - 1}{4}$$

7) Let R = {(1,4), (2,1), (3,4), (4,2)}. Find the matrix for the transitive closure.

--Amin Witno