



PHILADELPHIA UNIVERSITY
DEPARTMENT OF BASIC SCIENCES

Second Exam A

DISCRETE STRUCTURES

11-12-2012

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

1) The sequence 6, 11, 16, 21, 26, 31, ... is given by the function

a) $S(n) = 5n + 6$

b) $S(n) = (n+2)^2 + 2$

c) $S(n) = 3n + 6$

d) $S(n) = (n+1)^2 + 5$

2) Let $A = \{1, 2, 3, 4\}$ and $R = \{(a,b) \mid a + b > 3\}$. Which one is correct?

a) Reflexive (F); Symmetric (T); Anti-symmetric (F); Transitive (F)

b) Reflexive (F); Symmetric (T); Anti-symmetric (F); Transitive (T)

c) Reflexive (T); Symmetric (F); Anti-symmetric (T); Transitive (T)

d) Reflexive (T); Symmetric (F); Anti-symmetric (T); Transitive (F)

3) Let $R = \{(1,3), (2,3), (3,1)\}$. Find the transitive closure of R.

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

4) Find the equivalence classes from the equivalence relation

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

a) $\{1, 3\}, \{2, 4\}$

b) $\{1, 2\}, \{3, 4\}$

c) $\{1, 4\}, \{2, 3\}$

d) $\{1, 2\}, \{3\}, \{4\}$

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

5) Find the formula for the recursive sequence $S(n) = 2 S(n-1) + 15 S(n-2)$ given that $S(0) = 1$ and $S(1) = 3$.

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

$$1 + 8 + 64 + \dots + 8^{n-1} = \frac{8^n - 1}{7}$$

7) Let $A = \{2, 3, 4, 6, 12\}$ and $R = \{(a,b) \mid b \bmod a = 0\}$.

a) Draw the digraph of R.

b) Prove that R is a partial order relation.

c) Draw the Hasse diagram.

--Amin Witno