**D**epartment of Basic Sciences — Philadelphia University

**Final Exam** **Discrete Structures** **15–06–2016**

Part I. (2 points each) Circle one answer from the multiple choice.

1. Which set identity is true?

   (A) $(A \oplus B) - B = A$ (B) $(A \oplus B) \oplus B = A$
   (C) $(A - B) - B = A$ (D) $(A - B) \oplus B = A$

2. If $|A| = 11$, how many subsets of $A$ have 8 elements?

   (A) 990 (B) 165 (C) 110 (D) 55

3. Compute GCD (609, 234).

   (A) 9 (B) 6 (C) 3 (D) 2

4. How many from 1 to 200 are not multiples of 6 or 15?

   (A) 31 (B) 40 (C) 160 (D) 169

5. The matrix $\begin{bmatrix} 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ represents a relation that is

   (A) symmetric (T); anti-symmetric (T) (B) symmetric (T); anti-symmetric (F)
   (C) symmetric (F); anti-symmetric (T) (D) symmetric (F); anti-symmetric (F)

6. Convert the incidence matrix $\begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 \end{bmatrix}$ to adjacency matrix.

   (A) $\begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$ (B) $\begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$ (C) $\begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$ (D) $\begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$

7. Which graph has 12 edges?

   (A) $K_6$ (B) $K_{4,3}$ (C) $C_{24}$ (D) $P_{24}$

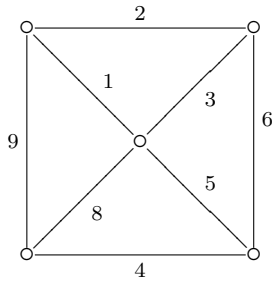
8. Which graph has diameter 3?

   (A) $K_4$ (B) $K_{4,4}$ (C) $C_4$ (D) $P_4$

9. Which graph is an Euler path?

   (A) $K_{2,5}$ (B) $K_{9,9}$ (C) $K_{12}$ (D) $K_{4,3}$

10. Find the total weight of the Minimal Spanning Tree (MST) for this graph.




(A) 9 (B) 10 (C) 11 (D) 12

Part II. (5 points each) Write complete solutions.

11. Let $R$ be the partial order relation given by the matrix

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

(a) Draw the graph.

(b) Draw the Hasse diagram.

(c) Is $R$ a total order relation?

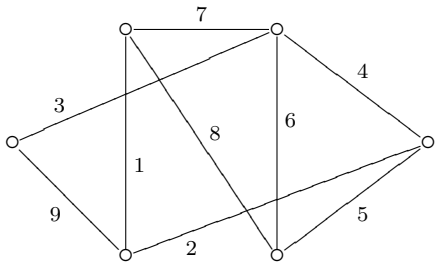
12. Find the function $S(n)$ given the recurrence relation $S(n) = S(n-1)+20S(n-2)$ with $S(0) = 3$ and $S(1) = 2$.

13. Let $R$ be the relation given by the matrix

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

Find the matrix of the transitive closure $\overline{R}$.

14. Solve the Chinese Postman Problem (CPP) for the given graph.




–Amin Witno