Department of Basic Sciences — Philadelphia University

Final Exam **Discrete Structures** **11–06–2017**

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

1. Convert the proposition $(p \wedge q) \oplus (p \vee q)$ to CNF.

   (A) $(\neg p \vee q) \wedge (p \vee q)$ (B) $(\neg p \vee \neg q) \wedge (p \vee \neg q)$

   (C) $(\neg p \vee q) \wedge (p \vee \neg q)$ (D) $(\neg p \vee \neg q) \wedge (p \vee q)$

2. $|P(\{1,2,3\}) - P(\{2,4\})| =$

   (A) 2 (B) 4 (C) 6 (D) 8

3. Compute LCM$(16, 36)$.

   (A) 112 (B) 128 (C) 144 (D) 192

4. Let $S(n) = 2S(n-1) + 3S(n-2)$ with $S(0) = 0$ and $S(1) = 1$. Find $S(4)$.

   (A) 11 (B) 20 (C) 32 (D) 39

5. Which matrix represent the relation $R = \{(x, y) \mid x \bmod 2 = y \bmod 3\}$?

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

6. Convert the incidence matrix $\begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \end{bmatrix}$ 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 degree 48?

   (A) $K_{6,4}$ (B) K_7 (C) K_6 (D) $K_{8,2}$

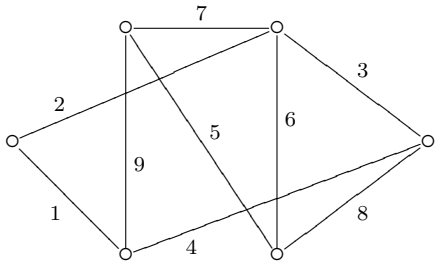
8. Which graph is a tree?

   (A) K_5 (B) K_4 (C) $K_{4,2}$ (D) $K_{1,5}$

9. Which graph has an Euler circuit?

   (A) K_6 (B) K_7 (C) $K_{5,2}$ (D) $K_{4,3}$

10. Find the total value of the Minimal Spanning Tree for this graph.



(A) 15 (B) 17 (C) 18 (D) 19

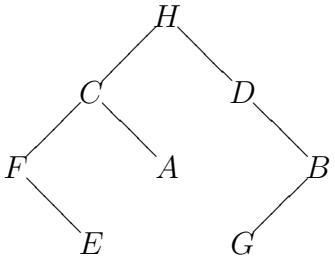
Part II. (4 points each) Write complete solutions.

11. Compute $11^{-1} \bmod 17$.

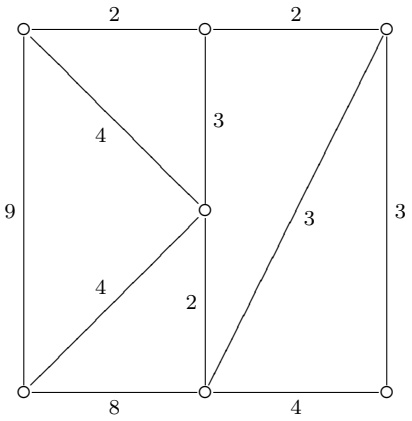
12. Count how many non-negative integer solutions in $A + B + C + D = 10$ with condition $A \leq 4$ and $B \leq 3$.

13. Let $A = \{2, 3, 4, 6, 12\}$. Draw the graph and the Hasse diagram for the partial order relation $R = \{(x, y) \mid x \bmod y = 0\}$ on A.

14. Find the output using (a) pre-order (b) in-order (c) post-order algorithms for the given binary tree.



15. Solve the Chinese Postman Problem for the given graph.



–Amin Witno