

Part 1. (2 points each) Circle your answer from the multiple choice.

1. Convert 1010110 from binary to decimal.

- (A) 82 (B) 84 (C) 86 (D) 88

2. Compute $(\{1, 2, 4\} \oplus \{3, 5\}) - \{1, 2, 3\}$.

- (A) $\{4, 5\}$ (B) $\{1, 4\}$ (C) $\{1, 5\}$ (D) $\{2, 3\}$

3. Compute LCM (21, 91).

- (A) 273 (B) 364 (C) 455 (D) 546

4. Find a recursive function for the sequence 1, 1, 3, 5, 9, 15, ...

- (A) $S(n) = S(n-1) \times S(n-2) + 2$ (B) $S(n) = S(n-1) + S(n-2) + 2$
 (C) $S(n) = S(n-1) \times S(n-2) + 1$ (D) $S(n) = S(n-1) + S(n-2) + 1$

5. Convert the relation $R = \{(x, y) \mid x \bmod y = 1\}$ to matrix.

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

6. Compute $\deg K_{4,2}$.

- (A) 16 (B) 18 (C) 20 (D) 30

7. Which graph is a tree?

- (A) K_5 (B) K_6 (C) $K_{1,4}$ (D) $K_{3,3}$

8. Which graph is an Euler circuit?

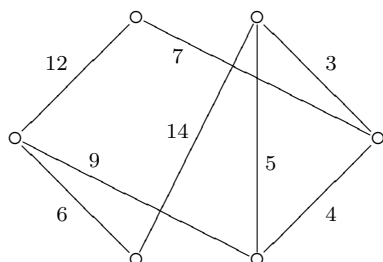
- (A) K_6 (B) $K_{2,3}$ (C) $K_{3,3}$ (D) $K_{4,2}$

Part 2. Write your solutions in the space provided.

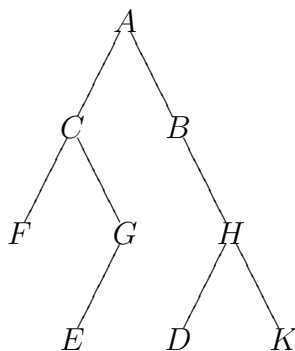
9. (3 points) Convert $(P \rightarrow Q) \rightarrow P$ to CNF.
10. (3 points) Compute $11^{-1} \pmod{25}$.
11. (5 points) Count how many non-negative integer solutions of $A + B + C = 14$ with condition $A \leq 4$ and $B \leq 8$.

12. (2 points) Find the matrix $S \circ R$, given $R = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ and $S = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$

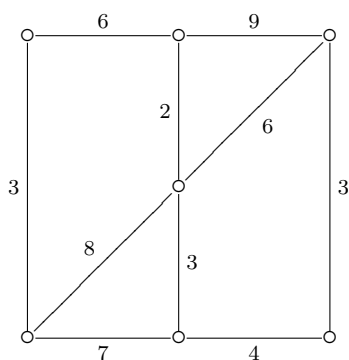
13. (2 points) Draw the minimum spanning tree.



14. (3 points) Write the output of (a) pre-order (b) post-order (c) in-order.



15. (4 points) Solve the Chinese Postman problem.



16. (2 points) Draw the dual graph and compute its chromatic number.

