K-19/2111

13024/NB

Mathematical Foundation of Computer Science-114

Sem-I

Time: 3hrs

M.M.- 70

Note: The Candidates are required to attempt two questions each from Section A & B Section C will be compulsory

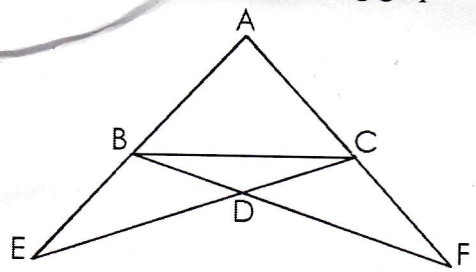
SECTION-A

1. State and Prove De-Morgan's Law of Set Theory. **(10.5)**
2. Let $f: X \to Y$ and $g: Y \to Z$ and let f, g be one-one onto maps, then prove that $gof: X \to Z$ is also one-one and onto. Also $(gof)^{-1} = f^{-1}og^{-1}$. **(10.5)**
3. Define sorting. Explain any one sorting algorithm with example. **(10.5)**
4. Use Principle of Mathematical Induction to show that

$$1^3 + 2^3 + 3^3 \ldots\ldots\ldots\ldots + n^3 = \left(\frac{n(n+1)}{2}\right)^2, \quad \forall n \in N. \qquad \textbf{(10.5)}$$

SECTION-B

5. Solve $S(k) - 7S(k-1) + 6S(k-2) = 0$. **(10.5)**
6. Prove that the distinct equivalence classes of an equivalence relation on a set form a partition of that set. **(10.5)**
7. Let $G = (V, E)$ be a connected planar graph and let R be the number of regions defined by any planar depiction of G, then $R = |E| - |V| + 2$. **(10.5)**
8. Construct an Euler Path or Euler Circuit in the following graph: **(10.5)**



SECTION-C

9. Attempt the following parts:
   - **a.** Find power set of $\{a, b, c\}$.
   - **b.** Define Symmetric difference.
   - **c.** What do you mean by inverse of a relation?
   - **d.** State the Pigeonhole principle.
   - **e.** Define Tautology and Contradiction with the help of example.
   - **f.** Show that $f(x) = x^2 + 2x + 1$ is $O(x^2)$.
   - **g.** Define an equivalence relation.
   - **h.** What do you mean by shortest path problem?
   - **i.** Define floor function and ceiling function.
   - **j.** What do you mean by complexity of an algorithm?

(10x2.8=28)