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Question Paper Code : 91790

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019
Fifth Semester
Computer Science and Engineering
MA 6566 – DISCRETE MATHEMATICS
(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART - A

(10×2=20 Marks)

1. Find the truth table for $p \rightarrow q$.
2. Express $A \leftrightarrow B$ in terms of the connectives $\{\wedge, \neg\}$.
3. State the pigeonhole principle.
4. Find the number of permutations of the letters in the word MISSISSIPPI?
5. Draw the complete bipartite graph $K_{3,4}$.
6. State hand shaking theorem.
7. Show that every cyclic group is abelian.
8. Let Z be the group of integers with the binary operation $*$ defined by $a * b = a + b - 2$, for all $a, b \in Z$. Find the identity element of the group $\langle Z, * \rangle$.
9. Define a lattice.
10. State the De Morgan's laws of Boolean Algebra.



PART - B

(5×16=80 Marks)

11. a) i) Prove that the premises $P \rightarrow Q$, $Q \rightarrow R$, $R \rightarrow S$, $S \rightarrow \sim R$ and $P \wedge S$ are inconsistent. (8)
- ii) Show that the premises "one student in this class knows how to write programs in JAVA" and "Everyone who knows how to write programs in JAVA can get a high paying job" imply the conclusion "Someone in this class can get a high-paying job". (8)
- (OR)
- b) i) Without constructing the truth tables, obtain the principle disjunctive normal form of $(\sim P \rightarrow R) \wedge (Q \leftrightarrow P)$. (8)
- ii) Show that $R \rightarrow S$ can be derived from the premises $P \rightarrow (Q \rightarrow S)$, $\sim R \vee P$ and Q . (8)
12. a) i) Prove that $\frac{1}{1.2} + \frac{1}{2.3} + \dots + \frac{1}{n(n+1)} = \frac{n}{n+1}$ using principle of induction. (8)
- ii) How many integers between 1 to 300 are there that are divisible by,
- 1) at least one of 3, 5, 7
 - 2) 3 and 5 but not by 7
 - 3) 5 but not 3 and 7. (8)
- (OR)
- b) i) A box contains six white balls and five red balls. Find the number of ways four balls can be drawn from the box if
- 1) They can be of any colour
 - 2) Two must be white and two red
 - 3) They must all be of the same color. (8)
- ii) Solve $D(k) - 7D(k-2) + 6D(k-3) = 0$, where $D(0) = 8$, $D(1) = 6$ and $D(2) = 22$. (8)
13. a) i) If G is a connected simple graph with n vertices with $n \geq 3$, such that the degree of every vertex in G is at least $\frac{n}{2}$, then prove that G has Hamilton cycle. (10)
- ii) If G is self complementary graph, then prove that G has $n \equiv 0$ (or) $1 \pmod{4}$ vertices. (6)

(OR)

- b) i) Define isomorphism between two graphs. Are the simple graphs with the following adjacency matrices isomorphic? (10)

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

- ii) Prove that the number of odd degree vertices in any graph is even. (6)

14. a) State and prove Lagrange's theorem on groups. (16)

(OR)

- b) i) Prove that every subgroup of a cyclic group is cyclic. (8)

- ii) Let $f: G \rightarrow H$ be a homomorphism from the group $\langle G, * \rangle$ to the group $\langle H, \Delta \rangle$. Prove that the kernel of f is a normal subgroup of G . (8)

15. a) i) In a complemented and distributive lattice, prove that complement of each element is unique. (8)

- ii) Prove that every chain is a distributive lattice. (8)

(OR)

- b) i) Consider the Lattice D_{105} with the partial ordered relation, "divides" then

1) Draw the Hasse diagram of D_{105} .

2) Find the complement of each elements of D_{105} .

3) Find the set of atoms of D_{105} .

4) Find the number of subalgebras of D_{105} . (8)

- ii) Show that in a Boolean algebra

$$a \leq b \Leftrightarrow a \wedge \bar{b} = 0 \Leftrightarrow \bar{a} \vee b = 1 \Leftrightarrow \bar{b} \leq \bar{a}. \quad (8)$$