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Question Paper Code : 42772

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018

Fifth Semester

Computer Science and Engineering

MA2265 – DISCRETE MATHEMATICS

(Common to Information Technology)

(Regulations 2008)

(Common to PTMA2265 – Discrete Mathematics for B.E. (Part-Time)

Third Semester – CSE – Regulations 2009)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A

(10×2=20 Marks)

1. Use Truth table, check whether $(P \wedge Q) \vee (\neg P \vee \neg Q)$ is a tautology or contradiction.
2. State the truth value of the statement : 'If tiger has wings, then the earth travel round the sun'.
3. State and prove Pigeonhole principle.
4. How many positive integers n can be formed using the digits 3, 4, 5, 5, 6, 6, 7 if n has to exceed 50,00,000 ?
5. Check whether the graph $K_{2,4}$ is Eulerian or Hamiltonian. Justify the claim.
6. What is meant by mixed graph ?
7. Let Z denote the set of all integers. A binary operation * is defined on Z by $a * b = a + b - ab$ for all a, b in Z. Is $(Z, *)$ a semigroup ?
8. Give an example of a ring which is not a field . Justify the claim.
9. Show that every totally ordered set is a lattice.
10. Give an example of a lattice which is complemented but not distributive.

11. a) i) Use truth table to show that $(P \rightarrow R) \wedge (Q \rightarrow R) \equiv (P \vee Q) \rightarrow R$. (8)
- ii) Give a proof by contradiction of the theorem "If $3n + 2$ is odd, then show that n is odd." (8)
- (OR)
- b) i) Show that $A \wedge S$ can be derived from the premises $P \rightarrow Q, Q \rightarrow \neg R, R, P \vee (A \wedge S)$. (8)
- ii) Show that $\neg(\forall x) (P(x) \rightarrow Q(x))$ and $(\exists x) (P(x) \wedge \neg Q(x))$ are logically equivalent. (8)
12. a) i) Prove that if m is an odd positive integer, then there exists a positive integer n such that m divides $2^n - 1$. (6)
- ii) Solve $a_n - 6a_{n-1} + 8a_{n-2} = 3^n, n \geq 2, a_0 = 0, a_1 = 7$. (10)
- (OR)
- b) i) Find the number $n, 1 \leq n \leq 1000$ such that n is not divisible by 2, 3 or 5. (8)
- ii) Solve $a_n - 2a_{n-1} - 3a_{n-2} = 0, n \geq 2, a_0 = 3, a_1 = 1$. (8)
13. a) i) Show that an undirected graph has an even number of vertices of odd degree. (8)
- ii) If G is a simple graph with n vertices and k -components, then show that the number of edges is at most $(n - k)(n - k + 1)/2$. (8)
- (OR)
- b) i) Test whether the graphs with the following adjacency matrices are isomorphic or not. (8)
- $$A = \begin{pmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{pmatrix}, \quad B = \begin{pmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{pmatrix}$$
- ii) Show that the complete bipartite graph $K_{m,n}$ is Hamiltonian if and only if $m = n$. (8)
14. a) i) If every element in a group is its own inverse, then show that G is an abelian group. (4)
- ii) Show that the order of a subgroup H of a finite group G divides the order of the group G . (12)

(OR)

- b) i) Show that the set of all permutations of three distinct elements with right composition of permutation is a permutation group. (10)
- ii) Show that if $f: \langle G, * \rangle \rightarrow \langle H, \Delta \rangle$ is a group homomorphism, then $\text{Ker}(f)$ is a normal subgroup of the group G . (6)
15. a) i) Let (P, \leq) be a poset. If the least element and greatest element exist, then show that they are unique. (6)
- ii) Show that in a lattice, isotone property and distributive inequalities are true. (10)
- (OR)
- b) Show that in a complemented and distributive lattice L , the following are true. For all x, y in L , (10)
- i) $a \leq b \Leftrightarrow a * b' = 0 \Leftrightarrow a' \oplus b = 1 \Leftrightarrow b' \leq a'$. (6)
- ii) $(a * b)' = a' \oplus b'$ and $(a \oplus b)' = a' * b'$.