



K18P 1392

Reg. No. :

Name :

First Semester M.C.A. Degree (Reg./Suppl./Imp.)
Examination, December 2018
(2014 Admn. Onwards)
MCA 1C01 : Discrete Mathematics

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Answer **any ten** questions from Section – **A**. Each question carries **three** marks.
2) Answer **all** questions from Section – **B**. Each question carries **ten** marks.

SECTION – A

Note : Answer **any ten** questions. Each question carries **three** marks.

1. Define logical equivalence. Show that $\neg(p \vee q)$ and $(\neg p) (\neg q)$ are logically equivalent.
2. Define tautology and contradiction. State whether the formula $(P \rightarrow Q) \vee (Q \rightarrow P)$ in a tautology or contradiction.
3. Express $(P \wedge Q) \vee (Q \wedge R)$ in disjunctive normal form.
4. Define Cartesian product of two sets A and B. If $A = \{1\}$ and $B = \{a, b\}$, $C = \{2, 3\}$ find B^2 and $B^2 \times A$.
5. Draw the Venn diagram for $(A - B) \cup (B - C) \cup (A - C)$.
6. Define one-to-one function along with an example.
7. What is an equivalence relation ? Let $A = \{1, 2, 3, 4\}$ be a set and R be an equivalence relation on A such that $A/R = \{\{1, 2\}, \{3, 4\}\}$. Write R.
8. If $A = \{1, 2, 3, 4, 5\}$ and R is a relation defined on A – $R : \{(a, b) : a|b\}$. Find R^o and R^{-1} .
9. How many different 15 persons committees can be formed each containing at least 4 Project Managers and at least 3 Programmers from a set of 10 Project Managers and 10 Programmers ?
10. State Pigeon hole principle. Using this principle show that in any group of 36 people, we can always find 6 people who were born on the same day of week.

P.T.O.



11. Define closure of graph with an example.
12. Define Hamiltonian and Eulerian graphs.

SECTION – B

Note : Answer **all** questions. **Each** question carries **ten** marks.

13. a) i) Define proposition. Prove that the following compound proposition is a tautology. $((P \Rightarrow Q) \wedge (Q \Rightarrow R) \Leftrightarrow (P \Rightarrow R))$. 5
- ii) Write the principal disjunctive normal form of i) $P \Rightarrow Q$ ii) $\sim (P \wedge Q)$. 5
- OR
- b) i) Show that $S \vee R$ is tautologically implied by $(P \vee Q) \wedge (P \rightarrow R) \wedge (Q \rightarrow S)$. 6
- ii) Obtain principal conjunctive normal form of $((P \rightarrow (Q \wedge R) \wedge (\sim P \rightarrow (\sim Q \wedge \sim R)))$. 4
14. a) i) If $f : A \rightarrow B$, $g : B \rightarrow C$ and $h : C \rightarrow D$, prove that $(hog) \circ f = ho (gof)$. 6
- ii) If A, B, C be any three sets, then using Venn diagram, prove that $A - (B \cup C) = (A - B) \cap (A - C)$. 4
- OR
- b) i) If $f : A \rightarrow B$ and $g : B \rightarrow C$ be one to one onto function, then prove that $(gof)^{-1} = f^{-1} \circ g^{-1}$. 6
- ii) If $A = \{1, 4\}$, $B = \{4, 5\}$ $C = \{5, 7\}$ verify that $A \times (B \cap C) = (A \times B) \cap (A \times C)$. 4
15. a) i) Let R be a relation defined on I such that $a \equiv b \pmod{3}$. Check whether R is an equivalence relation. If so, find out the partition on I . 5
- ii) Explain Warshall's algorithm with suitable example. 5
- OR
- b) i) Let $A = \{1, 2, 3, 4, 5\}$. Define a relation R on $A \times A$ by $(x_1, y_1) R (x_2, y_2)$ iff $x_1 + y_1 = x_2 + y_2$. 6
- i) Verify that R is an equivalence relation on $A \times A$.
- ii) Determine the equivalence classes of $[(1, 3)]$, $[(2, 4)]$ and $[(1, 1)]$.
- ii) For the sets $A = \{a, b, c\}$ and $B = \{1, 2, 3\}$ and the relations $R = \{(a, 1), (b, 1), (c, 2), (c, 3)\}$ and $S = \{(a, 1), (a, 2), (b, 1), (b, 2)\}$ from A to B compute $M_{(R \cap S)}$, $M_{(R \cup S)}$, $M_{(R^c)}$ and $M_{(S)}$. 4

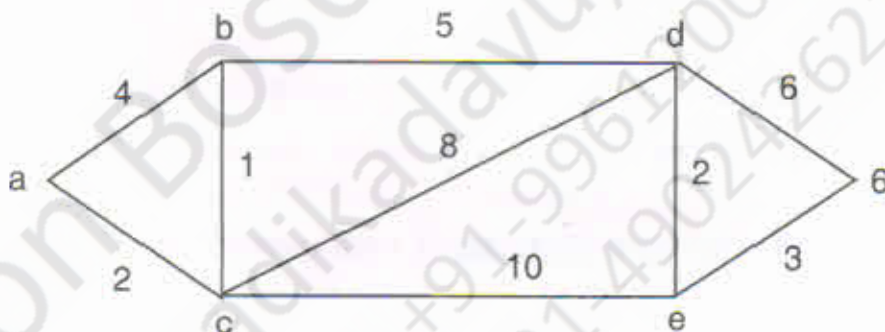


16. a) i) Use generating functions to solve the recurrence relation : $a_{n+2} - 2a_{n+1} + a_n = 2^n, a_0 = 2, a_1 = 1.$ 6
- ii) An Urn contains 15 balls, 8 red, 7 black. In how many ways can 5 balls be selected so that i) all are black ii) 2 red 3 black. 4

OR

- b) i) Show that if 7 numbers are chosen from 1.....12, then 2 of them will add upto 13. 6
- ii) Use principle of inclusion or exclusion to solve the following :
In a conference held in Mumbai, 500 delegates attend it. 200 of them would take tea, 350 would take coffee and 10 did not take either tea or coffee :
i) How many can take both tea and coffee ?
ii) How many can take tea only ? 4

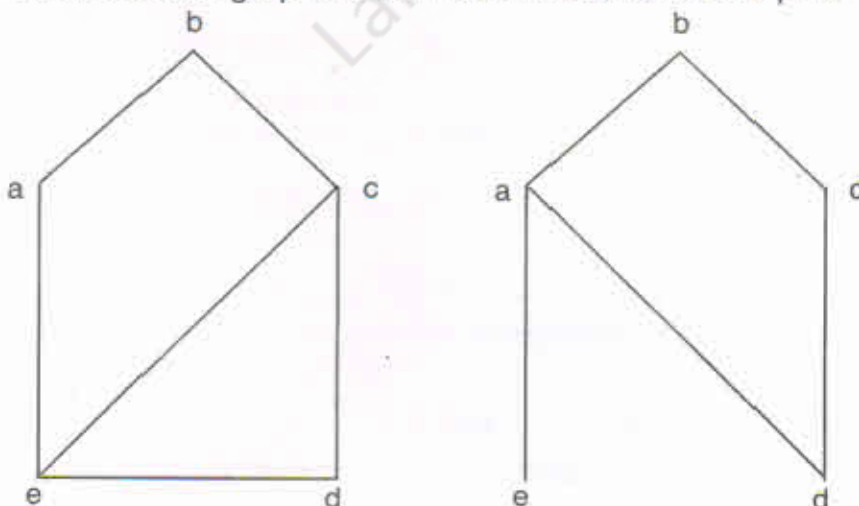
17. a) i) Using Dijkstra's algorithm, find the shortest path for the following.



- ii) Explain the following i) Directed and undirected graphs ii) connectivity. 4

OR

- b) i) Show that the graphs shown below are not isomorphic. 6



- ii) Explain the depth-first search procedure. 4