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 $\sim(p \vee q)$ and $(\sim p)$ $(\sim q)$ 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^c 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) of = ho (gof). **6**

ii) If A, B, C be any three sets, then using Venn diagram, prove that $A - (B \cup C) = (A - B) \wedge (A - C)$. **4**

OR

b) i) If $f : A \rightarrow B$ and $g : B \rightarrow C$ be one to one onto function, then prove that $(gof)^{-1} = f^{-1} \text{ o } g^{-1}$. **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 $a \equiv b \bmod 3$. 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 × 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 × 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

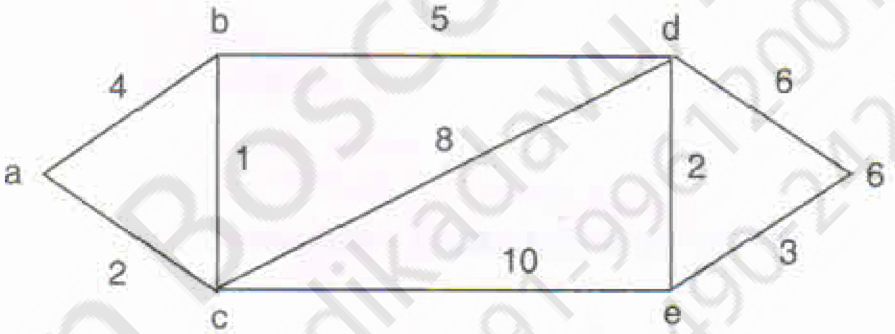
b) i) Show that if 7 numbers are chosen from 1......12, then 2 of them will add upto 13. **6**

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.

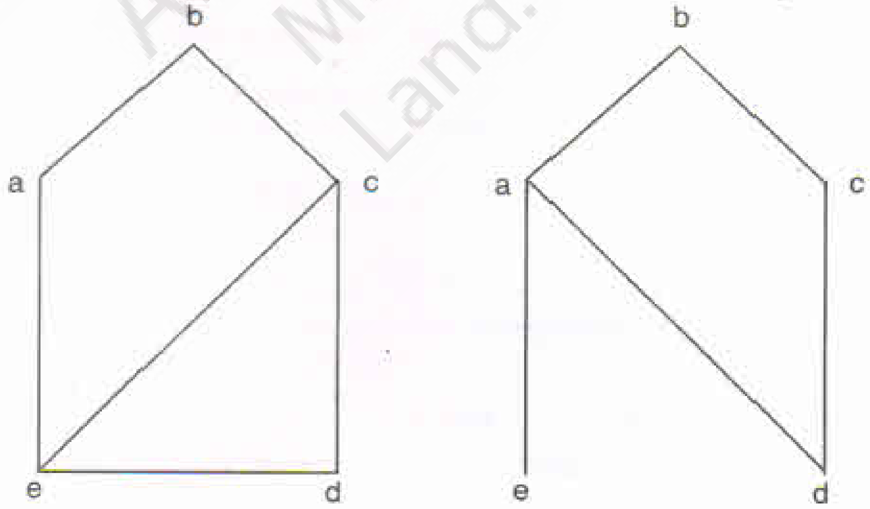


6

ii) Explain the following i) Directed and indirected 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**