M 26826

Reg. No. : ....

Name : ....

First Semester M.C.A. Degree (Reg./Sup./Imp.) Examination, February 2015
MCA1C01 : DISCRETE MATHEMATICS
(2014 Admn.)

Time : 3 Hours Max. Marks : 80

SECTION – A

Note : Answer **any ten** questions. **Each** question carries **three** marks : (10×3=30)

1. Construct the truth table for $\{(p \vee \sim q) \wedge (\sim p \vee \sim q)\} \vee q$.

2. Show that $\{p \wedge (\sim p \vee q)\} \vee \{q \wedge \sim (p \wedge q)\} = q$.

3. Define converse, inverse and contrapositive of proposition.

4. Define power set. Obtain the power set of $A = \{(a, b), c\}$.

5. Define the Cartesian product of two sets A and B. If $A = \{a, b, c\}$, $B = \{x, y\}$ and $C = \{0, 1\}$ find $A \times B \times C$ and $C \times B \times A$.

6. Let f and g be the functions from the set of integers to the set of integers defined by $f(x) = 2x + 3$ and $g(x) = 3x + 2$. Find $f \circ g$ and $g \circ f$.

7. Define reflexive closure and symmetric closure of a relation. What is the symmetric closure of $R = \{(a, b)/a>b\}$ on the set of positive integers ?

8. Define reflexive, symmetric and transitive relations.

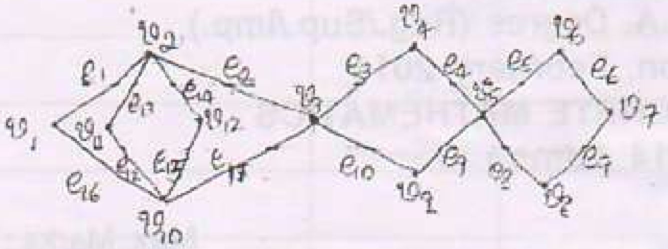
9. Determine whether the sequence $\{a_n\}$, where $a_n=3n$ for every nonnegative integer n, is a selection of the recurrence relation $a_n = 2a_{n-1} - a_{n-2}$ for n = 2, 3, 4 ..... Answer the same question where $a_n = 2^n$ and where $a_n = 5$.

10. How many ways can we get a sum 7 or 1 when two distinguishable dice are rolled ?

P.T.O.

11. Define walk, path and circuit in a graph.

12. Find the Fuler's circuit for the graph given below.



SECTION – B

Note : Answer **all** questions. **Each** question carries **ten** marks. **(5×10=50)**

13. a) i) Obtain the principal disjunctive normal form of $(\sim p \vee \sim q) \rightarrow (\sim p \wedge r)$.

ii) Show that $(\sim p \wedge (\sim q \wedge r) \vee (q \wedge r) \vee (p \wedge r)) \Leftrightarrow r$.

OR

b) i) Obtain the principal conjunctive normal form of $(p \wedge q) \vee (\sim p \wedge r)$.

ii) Define universal and extential quantifiers. Give example for each.

14. a) i) Use Venn diagram to show that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.

ii) Out of 30 students, 15 take an art course, 8 take a biology course and 6 take a chemistry course. It is known that 3 students take all the three courses. Show that 7 or more students take none of the courses.

OR

b) i) Let $f : A \rightarrow B$ and $g : B \rightarrow C$ are both one-one and onto. Show that $(g \circ f)^{-1} = f^{-1} \circ g^{-1}$.

ii) Let $f : R \rightarrow R$ is defined by $f(x) = ax + b$, where $a, b, X \in R$ and $a \neq 0$. Show that f is invertible and find the inverse of f.

15. a) i) If R is an equivalence relation on A, then show that $A|R$ is the partition of A.

ii) Explain Warshall's algorithm with suitable example.

OR

b) i) Write a note on n-ary relations and their applications.

ii) Let m be a positive integer with $m > 1$. Show that the relation $R = \{(a, b) \mid a \equiv b \pmod{m}\}$ is an equivalence relation on the set of integers.

a) i) Suppose that a person deposits Rs. 10,000 in a savings account at a bank yielding 11 % per year with interest compounded annually. How much will be in the account after 30 years ?

ii) State pigeonhole principle. Show that there are at least 6 different ways to choose 3 numbers from 1 to 10, So that all choices have the same sum.

OR

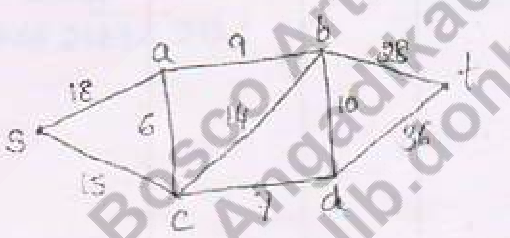
b) i) Show that

i) $\binom{n+1}{r} = \binom{n}{r} + \binom{n}{r-1}$

ii) $r.\,{}^{n}C_{r} = n.\,{}^{n-1}C_{r-1}$

ii) For any finite sets A, B, C show that $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(A \cap C) - n(B \cap C) + n(A \cap B \cap C)$.

17. a) i) Apply Dijkstra algorithm to find the shortest path from S to t in the graph given below.



ii) Define simple graph, pseudograph and multigraph with an example each.

OR

b) i) Define isomorphism. Show that the graphs G_1 and G_2 are not isomorphic.

ii) Using Kruskal's algorithm, find the minimal spanning tree of the graph given below.