



ST. FRANCIS DE SALES COLLEGE

A FRANSALIAN INSTITUTE OF HIGHER EDUCATION **AUTONOMOUS**

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END SEMESTER EXAMINATION – APRIL 2025
COMPUTER SCIENCE – I SEMESTER MCA
24MCA11 – MATHEMATICAL FOUNDATIONS FOR COMPUTER
SCIENCE

Time: 3 Hours

Max. Marks: 70

Instruction: *Answer should be written completely in English*

SECTION - A

Answer any **FIVE** questions. Each question carries **SIX** marks each.

(5X6=30)

1. Define R on $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$ by $(x, y) \in R$ if $x - y$ is a multiple of 5. Show that R is an equivalence relation on A .
2. Let $A = \{1, 2, 3, 4, 6\}$. Define a relation R on A by $R = \{(a, b) : a, b \in A \text{ such that } a \leq b\}$.
 - i. Write down the elements of R .
 - ii. Matrix representation of R .
 - iii. Digraph of R .
3.
 - i. Prove that $P \vee (P \wedge Q) \equiv P$ using truth tables.
 - ii. Construct truth tables for $(P \rightarrow Q) \wedge \neg Q$.
4.
 - i. Define a statement function and give its general form.
 - ii. What are all the three types of statement functions? Explain with an illustration to each.
5. Define the following with an example.
 - i. Digraph.
 - ii. Walk, path and circuit in a graph with illustrations.
6. A card is drawn at random from a standard pack of 52 cards. Find the probability of getting:
 - i. A jack or a queen or an ace.
 - ii. A two of spade or diamond.
7.
 - i. What is direct proof method? Illustrate.
 - ii. Prove that $n^2 - 2$ is not divisible by 4 if n is odd.
8. Define connected graphs and identify whether the following graphs G , H and J are connected graphs or not. Write how many components each of them have?

G	H	J

SECTION - B

Answer any **FOUR** questions. Each question carries **TEN** marks each.

(4X10=40)

9. i. Use contradiction method to prove that there are infinitely many primes.
ii. Write Fleury's Algorithm and illustrate.
10. i. Determine the validity of the following argument. Either Anchal will run or Vibha will speak. If Vibha speaks then Abhi will fly and the Rose is purple. The Rose is not purple, therefore Anchal will run.
ii. Show that $[P \rightarrow (Q \wedge R)] \equiv [(P \rightarrow Q) \wedge (P \rightarrow R)]$.
11. i. Define Eulerian and Hamiltonian graph. Give an example of a graph which is Hamiltonian but not Eulerian and vice versa.
ii. What are the two types of Matrix representations of a graph. Illustrate with an example to each.
12. i. Define the following:
 - a. Probability as Relative Frequency.
 - b. Axiomatic Definition of Probability.
 - c. Baye's formula.
 ii. Metro passengers arrive randomly and independently at the passenger-screening facility at a metro station. The mean arrival rate is 8 passengers per minute. a) Compute the probability of no arrivals in a 1-minute period. b) Compute the probability that there three or fewer passengers arrive in a 1-minute period.
13. i. A box contains 5 white, 3 red and 9 black balls. If 3 balls are drawn at random, find the probability that:
 - a. Two of the balls drawn are white.
 - b. One is of each colour.
 - c. None is red.
 - d. At least one is white.
 ii. What is a bipartite graph? Give an example and write the adjacency matrix and incidence matrix of it.
14. i. Define one-to-one and onto functions with an example.
ii. Determine which of the following functions from Z to Z is one-to-one.
 - a. $f(n) = n - 1$.
 - b. $f(n) = n^2 + 1$.
 - c. $f(n) = n^3$.

