**2021**

# MATHEMATICAL FOUNDATION IN COMPUTER SCIENCE

*FULL Marks: 100*

Time: Three hours

*The figures in the margin indicate full marks for the questions.*

*Answer any five questions*

1.
$(8 + 6 + 6)$

a) Find the domain and range of the function $f(x) = \sqrt{25 - x^2}$

b) Show that the relation R defined by $(a, b)\, R\, (c, d) \Rightarrow a + d = b + c$ on the set N×N is an equivalence relation.

c) Let the function f: R → R be defined by $f(x) = cosx$, $\forall x \in R$. Show that f is neither one-one nor onto.

2.
$(10 + 8 + 2)$

a) Define poset. Show that the inclusion relation $\subseteq$ is a partial ordering on the power set of a set S.

b) Draw the Hasse diagram representing the partial ordering $\{(a, b)\, |a$ divides b$\}$ on $\{1, 2, 3, 4, 6, 8, 12\}$.

c) Is the hasse diagrams a lattice?

3.
$(8 + 12)$

a) Define recursion. State the advantage and disadvantage of recursion.

b) Establish the recurrence relation of Tower of Hanoi problem and solve that recursion.

1

4)                                                                (10 + 10)

a) Define spanning tree. Find the minimum spanning tree of the given graph using Kruskal's Algorithm.
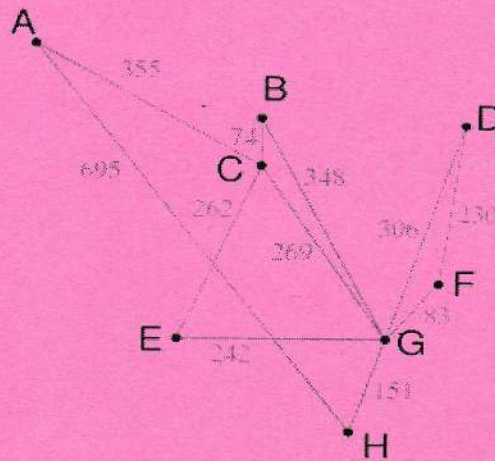


b) Describe the depth-first search algorithm. Do the breadth-first search on the above graph.
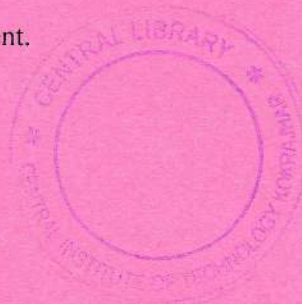
5.                                                                (5 + 5 + 5 + 5)

a) Prove that $(p \wedge q) \rightarrow (p \vee q)$ is a tautology.

b) If $P(x)$ be the statement "$x < c + 2$" c is a constant. What is the truth value of the quantification $\forall x P(x)$ and $\exists x P(x)$, where the domain consists of all real numbers?

c) Express the statement "Every student in this class has studied MFCS" into logical expression.

d) Write the negation of the above statement.

2

6. $(5 + 5 + 5 + 5)$

a) There are 10 students in a class. Show that at least two of you born on the same day of the week.

b) If e is the identity element, then ($\{e\}$, *) is a group? Justify your answer.

c) In a exam hall there are 12 seats for the 10 students. How many different seating arrangement is possible?

d) The Cartesian product $A \times A$ has 9 elements and $\{(-1, 1), (0, 0)\} \subset A \times A$. **Find the set A.**