diagram. What is proper subset? Explain with the help of an example. What are the properties of Binary Relations? 3+2+1+4

24. (i) Solve the recurrence relation :

$$a_n = 2a_{n-1} + 2^n;\ a_0 = 2$$ 5

(ii) For every positive integer $n$, prove that $7^n - 3^n$ is divisible by 4. 5

25. (i) Define planner graph with example. Draw a $Q_3$ graph. Is $Q_3$ is a planner graph? Justify. 2+2

(ii) The graph $G$ has 6 vertices with degrees 2, 2, 3, 4, 4, 5. How many edges does $G$ have? Could it be planner? If so, how many faces would it have? If not explain. 6

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# 2024

## 2nd Semester Examination

## COMPUTER SCIENCE (Honours)

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### Paper : C 4-T

### (Discrete Structure)

**[CBCS]**

Full Marks : 60 Time : Three Hours

*The figures in the margin indicate full marks.*
*Candidates are required to give their answers in their own words as far as practicable.*

### Group - A

Answer any ***ten*** questions. 2×10=20

1. Define Path and Circuit in a graph.
2. Show that V3 is irrational.
3. Define cartesian product of two set with a proper example.
4. What is proper subset? Explain with the help of an example.
5. Draw the Venn diagram for the expressions
(i) $A \cup B \cap C$ (ii) $A \cap B \cap C$.

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6. Write the following statements in the symbolic form :

   (i) Everything is correct.

   (ii) All birds cannot fly.

7. For two sets $A$ and $B$, let $A \Delta B$ denote the set of elements which belong to $A$ or $B$ but not both. If $P = \{1, 2, 3, 4\}$, $Q = \{2, 3, 5, 6\}$, $R = \{1, 3, 7, 8, 9\}$, $S = \{2, 4, 9, 10\}$, then find the number of elements in $(P \Delta Q) \Delta (R \Delta S)$.

8. Find the maximum number of edges in $K_{13}$.

9. Define a complete Graph with a suitable example.

10. Show that $(p \to q) \to q = p \vee q$.

11. Show that $p \wedge (p \vee q) \leftrightarrow p$ is a tautology.

12. How many 3-letter words can be formed from the letters of the word "HAPPY"?

13. What is contradiction?

14. Define multigraph with example.

15. If $A = \{2, 3, 4, 5\}$ and $B = \{0, 1, 2, 3\}$, find $(A \cap B)$.

## Group - B

Answer any ***four*** questions. 5×4=20

16. If $A = \{1, 4\}$, $B = \{2, 3, 6\}$, $C = \{2, 3, 7\}$, then verify that $A \times (B - C) = (A \times B) - (A \times C)$.



17. In how many ways 9 balls can be selected from 6 red balls, 5 white balls and 5 blue balls if each selection consists of 3 balls of each colours?

18. A simple graph contains 35 edges, four vertices of degree 5, five vertices of degree 4 and four vertices of degree 3. Find the number of vertices with degree 2.

19. Prove that a simple graph with $n$ vertices and $k$ components can have at most $\frac{(n-k)(n-k+1)}{2}$ edges.

20. Using Mathematical Induction, prove that :

$$1 + 2 + 3 + \cdots + n = \frac{n(n+1)}{2}$$

21. Show that in any group of 30 people, you can always find 5 people who were born on the same day of the week.

## Group - C

Answer any ***two*** questions. 10×2=20

22. (i) If ${}^{2n}C_3 : {}^{n}C_3 = 11 : 1$, find $n$. 5

    (ii) How many distinct four digit integer can one make from the digits 1, 3, 3, 7, 7, 8? 5

23. Explain De Morgan's Laws with the help of Venn

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