ST JOSEPH'S UNIVERSITY, BENGALURU -27
BCA (DATA ANALYTICS) – I SEMESTER
SEMESTER EXAMINATION : OCTOBER 2023
(Examination Conducted in November/December 2023)
BCADA 1321 – DISCRETE MATHEMATICS I
(For current batch students only)

**Time: 2 hours**   **Max. Marks: 60**
This paper contains THREE printed pages and THREE parts.

PART- A

Answer all questions: **5 X 2 =10**

1. Define disjunction of two propositions p and q. Write the truth table for disjunction of two propositions p and q.

2. What is a power set ? If $S = \{3, \{1, 4\}\}$ then determine $P(S)$.

3. Evaluate $\lim\limits_{x \to 0} x \sin \dfrac{1}{x}$.

4. Define order and size of a graph G. Indicate the order and size of the given graph G.
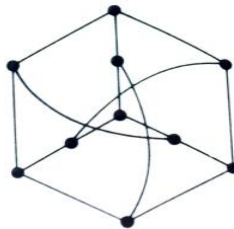
5. If a tree T has 2000 vertices , find the sum of degrees of the vertices of T.

PART- B

Answer any FIVE questions: **5 X 4 = 20**

6. Define the term tautology. Check if $(p \Rightarrow q) \Leftrightarrow (\neg p \vee \neg q)$ is a tautology.

7. If $A = \{1, 2, 3, 4\}$, $B = \{3, 4, 5, 6\}$, $C = \{2, 4, 6\}$ then find the following.
   (i) $(A \times B) \cap (B \times C)$ (ii) $(A \times B) - (B \times C)$ (iii) $A \times (B \cup C)$ (iv) $(A \cap B) \times C$.

8. What are the necessary conditions for the function $f(x)$ to be continuous at $x = a$.
   Check if the function $f(x) = x^2 - 2x + 3$ is continuous at $x = 3$.

9. What is the quotient rule of differentiation? Find the derivative of $\dfrac{(x+2)^3}{\sqrt{x}}$.

10. Define in-degree and out-degree of a digraph D. Also find the in-degrees and out-degrees of the digraph D given below.
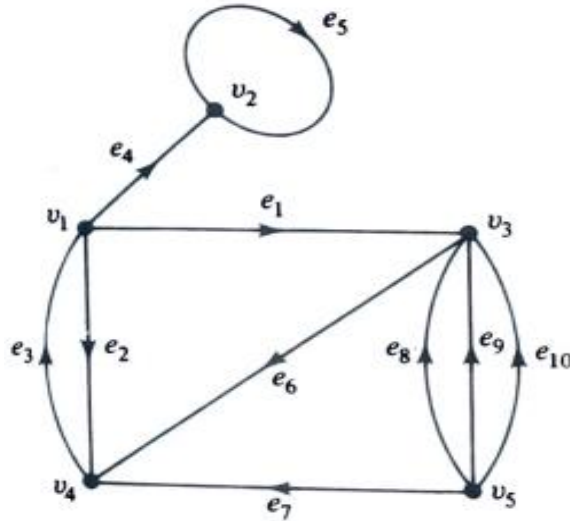
11. What is the chromatic number of a graph G? Find the chromatic number of a graph given below.
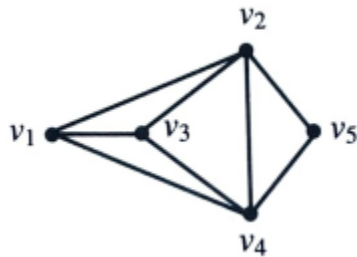
12. Show that the graph K_5 is non planar.

PART- C

Answer any THREE questions: **3 X 10 = 30**

13. a) Explain the rules of inference for propositional logic.

    b) Test the validity of the following argument.

       If Ravi goes out with friends, he will not study.
       If Ravi does not study, his father becomes angry.
       His father is not angry.
       _____
       ∴ Ravi has not gone out with friends.   (6+4)

14. a) Define an equivalence relation. If R is a relation on the set of integers defined by $a\,R\,b$ if and only if $a-b$ is an integer then prove that R is an equivalence relation.

b) What is a bijective function. Let Z be the set of all integers. If we define $f:Z\rightarrow Z$ by $f(x)=2x+3$ for all $x\in Z$ then show that f is bijective.   (5+5)
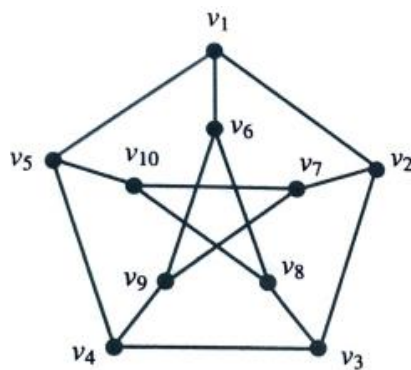
15. a) Define the differentiability of a function $f(x)$ at the point $x=c$. Examine the

differentiability of the function $f(x)=\begin{cases} x^2 & if \quad x\le 3 \\ 6x-9 & if \quad x>3 \end{cases}$ $at\ the\ point\ x=3.$

b) State Rolle's theorem. Discuss the applicability of Rolle's theorem on the function

given by $f(x)=\begin{cases} x^2+1 & if \quad 0\le x\le 1 \\ 3-x & if \quad 1\le x\le 2 \end{cases}$.   (5+5)
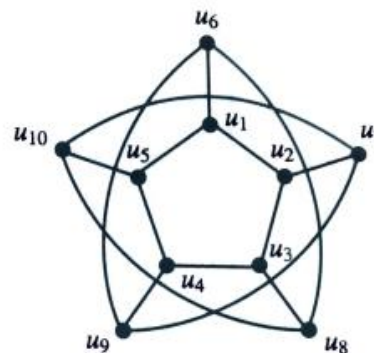
16. a) Explain the Kruskal's algorithm. Also find the minimum spanning tree of the given
graph by Kruskal's algorithm.
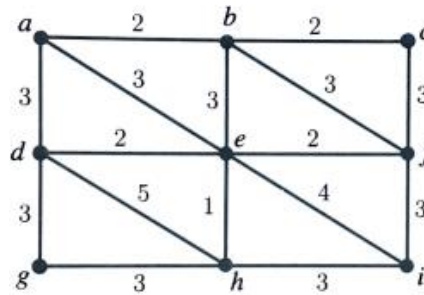
b) Verify whether the two graphs given below are isomorphic.

(a)

(b)   (6+4)