

B.C.A. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

Second Semester

Computer Applications — Allied

MATHEMATICAL FOUNDATION FOR COMPUTER
SCIENCE

(For those who joined in July 2021-2022)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

- A set consisting of just one element is called a _____
(a) Singular Set (b) Closed Set
(c) Singleton Set (d) Open Set
- $(A - B) - C =$ _____
(a) $(A - C) - (B - C)$ (b) $(A - B) - (A - C)$
(c) $(B - A) - (B - C)$ (d) $(A - B) - (B - C)$

- A graph with vertices but no edges is called _____
(a) Simple graph (b) Trivial graph
(c) Null graph (d) Euler graph
- A _____ of a graph G is an edge whose removal disconnects the graph.
(a) Bridge (b) Cut edge
(c) Link (d) Cut vertex
- A _____ tree is a rooted tree in which every vertex has atmost two children.
(a) Spanning (b) b -tree
(c) General (d) Binary

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

- (a) In an examination, 75% of students passed in Physics and 85% in Chemistry, 70% in both. What percentage of the students failed in both?
Or
(b) Show that the relation $\rho = \{(a, b) : 2 \text{ divides } (a - b)\}$ is an equivalence relation.

- If $f : X \rightarrow Y, g : Y \rightarrow Z$ be two functions, then if $g \circ f$ is 1-1 then f is _____.
(a) Either 1-1 or onto (b) Neither 1-1 nor onto
(c) Onto (d) 1-1
- The function $F : X \rightarrow X$ such that $F = \{(x, x), x \in X\}$ is called _____ function on X .
(a) Singular (b) Identity
(c) Singleton (d) Unique
- The conjunction of two statements P and Q is true when _____.
(a) Either P or Q is true
(b) Both P and Q are true
(c) Only when P is true
(d) Only when Q is true
- $(P \rightarrow Q) \wedge (Q \rightarrow P) \Leftrightarrow$ _____.
(a) $P \rightarrow Q$ (b) $Q \Leftrightarrow P$
(c) $P \Leftrightarrow Q$ (d) $Q \rightarrow P$
- A graph that has neither self-loops nor parallel edges is called _____.
(a) Simple graph (b) Trivial graph
(c) Null graph (d) Euler graph

- (a) If $f : X \rightarrow Y, g : Y \rightarrow Z$ and $h : Z \rightarrow S$ are functions, then show that $h \circ (g \circ f) = (h \circ g) \circ f$.
Or
(b) Prove that the function $f : R \rightarrow R$ given by $f(x) = 2x$ is one-one and onto.
- (a) Construct the truth table for $Q \wedge (P \rightarrow Q) \rightarrow P$.
Or
(b) Show that $(P \wedge Q) \vee \neg P \Leftrightarrow Q \vee \neg P$.
- (a) Prove that the sum of degrees of the vertices of a graph G is twice the number of edges.
Or
(b) Write a note on bipartite graph.
- (a) Write a note on Euler graph.
Or
(b) Mention the properties of trees.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) For any finite sets A and B , using principle of inclusion-exclusion, show that $|A \cup B| = |A| + |B| - |A \cap B|$.

Or

- (b) Prove that the equivalence of any two equivalence relation is an equivalence relation.

17. (a) Show that $f: R \rightarrow R$ defined by $f(x) = 7x - 1$ is a bijection and find its inverse. Compute $f^{-1} \circ f = f \circ f^{-1}$.

Or

- (b) Explain the types of functions.

18. (a) Construct the truth table to show that $(P \wedge (P \rightarrow Q)) \rightarrow Q$ is a tautology.

Or

- (b) Obtain the principle disjunctive normal form for $(P \wedge Q) \vee (\neg P \wedge Q \wedge R)$.

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19. (a) Prove that the number of vertices of odd degree in a graph G is always even.

Or

- (b) Explain the operations on graph.

20. (a) Prove that in a graph G , every walk contains a path.

Or

- (b) Show that the number of pendant vertices in a binary tree is $(n+1)/2$.

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