

(7 pages)

Reg. No. :

Code No. : 30271 E

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B.C.A. (CBCS) DEGREE EXAMINATION,
APRIL 2022

Second Semester

Computer Application – Allied

MATHEMATICAL FOUNDATION FOR COMPUTER
SCIENCE

(For those who joined in July 2016 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Two sets A and B are mutually exclusive if
- (a) $A \cup B = \text{null}$
 - (b) $A - B = \text{null}$
 - (c) $A \cap B = \text{null}$
 - (d) $B - A = \text{null}$

2. The power set of a set containing ' n ' elements has _____ elements.

- (a) n^2
- (b) 2^n
- (c) n
- (d) $2n$

3. The other name for one-one function is

- (a) surjective
- (b) bijective
- (c) injective
- (d) mapping.

4. A function defined on a set which maps every element to itself is called _____ function.

- (a) inverse
- (b) composite
- (c) identity
- (d) bijective.

5. The truth value of $p \vee q$ is false only if _____

- (a) p is false
- (b) q is false
- (c) both p and q are false
- (d) both p and q are true.

6. $P \vee (\neg P \wedge Q) \Leftrightarrow$

- (a) $P \wedge Q$
- (b) $P \vee Q$
- (c) both (a) and (b)
- (d) none.

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7. A vertex having no edge incident on it is called _____

- (a) isolated vertex (b) pendant vertex
(c) end vertex (d) null.

8. The degree of every vertex in a complete graph of n vertices is _____

- (a) n (b) $n-1$
(c) 2 (d) 3

9. In a graph G , every _____ contains a path.

- (a) vertex (b) walk
(c) node (d) loop.

10. A tree is a connected _____ graph.

- (a) cyclic (b) acyclic
(c) euler (d) complete.

PART B — ($5 \times 5 = 25$ marks)

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

Each answer should not exceed 250 words.

11. (a) Prove that $A \cup B = B$ iff $A \subseteq B$.

Or

(b) Prove that $A \cap B = \phi$ iff $A - B = A$.

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12. (a) Show that $f: R \rightarrow R$ defined $f(x) = 3x$ is a bijection. Find f^{-1} .

Or

(b) Show that, if $F: X \rightarrow Y$ and $g: Y \rightarrow Z$ are bijections, then $(g \circ f)^{-1} = f^{-1} \circ g^{-1}$.

13. (a) Construct the truth table for $Q \wedge (P \rightarrow Q) \rightarrow P$.

Or

(b) Prove that $Q \rightarrow P \Leftrightarrow \neg P \rightarrow \neg Q$. Using truth table.

14. (a) Define (i) graph (ii) subgroups.

Or

(b) Let G be a K -regular bigraph with bipartition V_1 and V_2 and $b > 0$. Show that $|V_1| = |V_2|$.

15. (a) Prove that in a graph G , any $u-v$ walk contains a $u-v$ path.

Or

(b) Prove that the number of vertices n in a binary tree is always odd.

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[P.T.O.]



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 set A and B prove that

$$|A \cup B| = |A| + |B| - |A \cap B|.$$

Or

- (b) In a group of 60 girls, 25 play badminton, 20 play table tennis, and 30 play volley ball. 12 play badminton and table tennis, 9 play table tennis and volley ball. 13 play volley ball and badminton. 5 play all the three games. Find how many of them play

- (i) Name of the games
- (ii) Only Volleyball
- (iii) Only badminton.

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

Or

- (b) Prove that if $f: X \rightarrow Y$ is bijection, then $f^{-1} \circ Y \rightarrow X$ is also bijection and $f^{-1} \circ f = i_x$ and $f \circ f^{-1} = i_y$.

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18. (a) Show that

$$P \rightarrow (Q \rightarrow R) \Leftrightarrow P \rightarrow (\neg Q \vee R) \Leftrightarrow (P \wedge Q) \rightarrow R.$$

Using truth table.

Or

- (b) Find the principal disjunctive normal form for the formula

$$(P \rightarrow Q \vee R) \wedge (\neg Q) \wedge (\neg R) \wedge Q \text{ using truth table.}$$

19. (a) The maximum number of lines among all ' P ' point graphs with no triangle is $(P^2/4)$. Prove it.

Or

- (b) Define the following and give example for each :

- (i) Simple graph
- (ii) Complete graph
- (iii) Pseudo graph
- (iv) Weighted graph.

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20. (a) For every tree $T = (V, E)$ prove the following properties :

- (i) There is a unique path between every pair of vertices.
- (ii) Tree with n vertices has $n - 1$ edges.

Or

(b) For a binary tree, prove the following :

- (i) The no. of vertices n in a binary tree is always odd.
 - (ii) The no. of pendant vertices in a binary tree is $\frac{(n+1)}{2}$.
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