..es)   **Reg. No. :** ....

ɔɑe No. : 30271 E   **Sub. Code : JACA 21/ SACA 21/AACA 21/ CACA 21**

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

Second Semester

Computer Application – Allied

HEMATICAL FOUNDATION FOR COMPUTER SCIENCE

(For those who joined in July 2016 onwards)

Three hours   Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

Two sets A and B are mutually exclusive if

(a) $A \cup B =$ null

(b) $A - B =$ null

(c) $A \cap B =$ null

(d) $B - A =$ 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.

A vertex having no edge incident on it is called ————

(a) isolated vertex   (b) pendant vertex

(c) end vertex   (d) null.

The degree of every vertex in a complete graph of n vertices is ————

(a) n (b) $n-1$

(c) 2   (d) 3

In a graph G, every ———— contains a path.

(a) vertex   (b) walk

(c) node   (d) loop.

A tree is a connected ———— graph.

(a) cyclic   (b) acyclic

(c) euler   (d) complete.

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

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

Or

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

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

Or

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

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

Or

(b) Prove that $Q \to P \Leftrightarrow \neg P \to \neg Q$. 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 is a binary tree is always odd.

PART C — ($5 \times 8 = 40$ 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 $f : R \to R$ 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 $f : X \to Y$ is bijection, then $f^{-1} \circ Y \to X$ is also bijection and $f^{-1} \circ f = i_x$ and $f \circ f^{-1} = i_y$.

18. (a) Show that

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

Using truth table.

Or

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

$(P \to Q \vee R) \wedge (\neg Q) \wedge (\neg R) \wedge Q$ using truth table.

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

Or

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

(i) Simple graph

(ii) Complete graph

(iii) Pseudo graph

(iv) Weighted graph.

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 $\dfrac{(n+1)}{2}$.
