

Professional Course Examination, May 2024

(CBCS)

(2nd Semester)

BACHELOR OF COMPUTER APPLICATIONS

(Discrete Mathematics)

Full Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

(PART : A—OBJECTIVE)

(Marks : 25)

SECTION—I

(Marks : 15)

A. Tick (✓) the correct answer in the brackets provided :

1×10=10

1. Two sets A and B are said to be disjoint if

(a) $A \cap B = \phi$ ()

(b) $A \cap B \neq \phi$ ()

(c) $A \cup B = \phi$ ()

(d) $A \cup B \neq \phi$ ()

2. In Boolean algebra, $x \cdot (x' + y)$ is equal to

(a) $x + y$ ()

(b) $x - y$ ()

(c) $x \cdot y$ ()

(d) x ()

3. A statement formula which is true regardless of the truth values of the statements is a/an
 - (a) tautology ()
 - (b) connective ()
 - (c) equivalence ()
 - (d) normal form ()
4. Which of the following is not a proposition?
 - (a) $9 < 6$ ()
 - (b) $1 + 1 = 2$ ()
 - (c) Paris is in France ()
 - (d) Where are you going? ()
5. The value of ${}^{12}P_4$ is
 - (a) 11880 ()
 - (b) 22880 ()
 - (c) 18180 ()
 - (d) 12402 ()
6. How many permutations can be made out of the letters of the word TRIANGLE?
 - (a) 40330 ()
 - (b) 40320 ()
 - (c) 40230 ()
 - (d) 20430 ()
7. The greatest common divisor of 23 and 642 is
 - (a) 23 ()
 - (b) 642 ()
 - (c) 1 ()
 - (d) 13 ()
8. The Euler's Phi for 35 is
 - (a) 45 ()
 - (b) 24 ()
 - (c) 33 ()
 - (d) 23 ()

9. The chromatic number of 5 vertices of a graph is

- (a) 5 ()
- (b) 4 ()
- (c) 3 ()
- (d) 2 ()

10. The spanning tree of connected graph with 12 vertices contains the edges of

- (a) 11 ()
- (b) 12 ()
- (c) 9 ()
- (d) 10 ()

B. Indicate whether the following statements are *True (T)* or *False (F)* by putting a Tick (✓) mark in the brackets provided : 1×5=5

1. If U is the universal set and $A \subset U$, then $A \cap A'$ is ϕ .

(T / F)

2. A statement is of the form ' p if and only if' is called conditional statement.

(T / F)

3. 6 persons can occupy 4 vacant seats in 640 ways.

(T / F)

4. $\text{GCD}(a, b) = 1$ when a and b are co-prime.

(T / F)

5. In a multigraph, loops and more than one edges are allowed.

(T / F)

SECTION—II

(Marks : 10)

C. Answer the following questions :

2×5=10

1. (a) Let $A = \{1, 2, 3, 5, 6\}$, $B = \{3, 4, 6, 8\}$ be two subsets of the universal set $U = \{1, 2, 3, 4, 5, 6, 7, 8\}$. Draw Venn diagrams to represent the following sets :

(1) A' , (2) B' , (3) $A \cup B$, (4) $A \cap B$, (5) $(A \cup B)'$, (6) $(A \cap B)'$

OR

- (b) Using Boolean algebra, verify using the truth table that $x + xy = x$ for each x, y in $\{0, 1\}$.

2. (a) Verify that the proposition $p \vee (p \wedge q)$ is tautology.

OR

- (b) Show that the proposition $\neg(p \wedge q)$ and $\neg p \vee \neg q$ are logically equivalent.

3. (a) If ${}^nP_4 = 2 \times {}^5P_3$, then find the value of n .

OR

- (b) If ${}^nC_{14} = {}^nC_{16}$, then find the value of ${}^nC_{28}$.

4. (a) If $a | bc$ and $\gcd(a, b) = 1$, then prove that $a | c$.

OR

- (b) Find the GCD and LCM of 482 and 1687 using Euclidean algorithm.

5. (a) Define graph colouring and give an example of it.

OR

- (b) Define Hamiltonian graph and give an example of it.

(PART : B—DESCRIPTIVE)

(Marks : 50)

D. Answer the following questions :

10×5=50

1. (a) In a group of 850 persons, 600 can speak Hindi and 340 can speak Tamil. Find—

- (i) how many can speak both Hindi and Tamil;
- (ii) how many can speak Hindi only;
- (iii) how many can speak Tamil only.

6

- (b) Let $A = \{a, b, c, d, e\}$, $B = \{a, b, d, f, g\}$, $C = \{b, c, e, y, h\}$ and $D = \{d, e, f, g, h\}$. Find—

- (i) $A \cup B$
- (ii) $A \cap (B \cup D)$
- (iii) $B \cap C$
- (iv) $A \cap (C \cup D)$

4

OR

- (c) Construct the switching table for the function $f(xyz) = x + yz$.

6

- (d) Using Boolean's law, prove that $U' + V = UV' + UV + UV$.

4

2. (a) Construct a truth table for the following statement formulas :

5

- (i) $p \wedge \neg q$ and $\neg p \vee \neg q$
- (ii) $\neg(p \vee q) \equiv \neg p \wedge \neg q$

- (b) Verify that the proposition $(p \wedge q) \wedge \neg(p \vee q)$ is a contradiction.

5

OR

- (c) Show that $\neg(p \wedge q) \rightarrow (\neg p \vee (\neg p \wedge q)) \leftrightarrow (\neg p \wedge q)$.

5

- (d) Show that (i) $p \wedge q$ logically implies $p \leftrightarrow q$ and (ii) $p \leftrightarrow \neg q$ does not logically imply $p \rightarrow q$.

5

3. (a) Find the 10th term in the expansion of

$$\left(2x^2 + \frac{1}{x}\right)^{12}$$

- (b) Find the coefficient of x^7 in the expansion of

$$\left(x^2 + \frac{1}{x}\right)^{11}$$

OR

- (c) Find the term independent of x in the expansion of

$$\left(2x - \frac{1}{x}\right)^{10}$$

- (d) Find the 7th term in the expansion of

$$\left(\frac{4x}{5} + \frac{5}{2x}\right)^8$$

4. (a) Prove that for positive integers a and b

$$\gcd(a, b) \times \text{lcm}(a, b) = ab$$

- (b) State and prove Euler's theorem.

OR

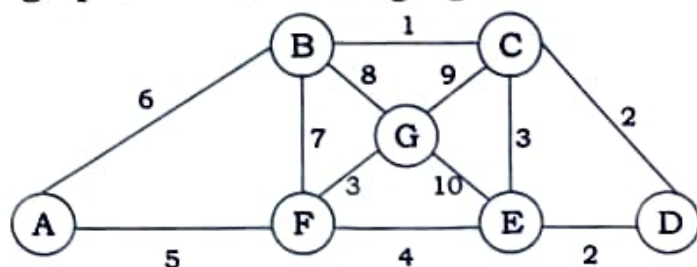
- (c) Use Euclidean algorithm to obtain integers x and y satisfying the following :

$$\gcd(56, 72) = 56x + 72y$$

- (d) State and prove Euclid's lemma.

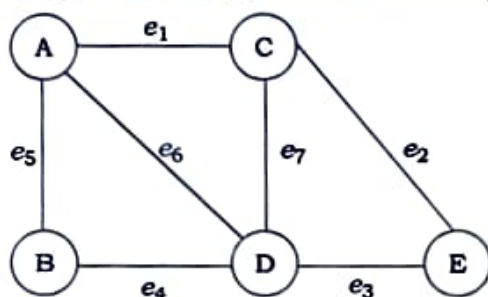
5. (a) Using Prim's algorithm, find the minimum spanning tree for the weighted graph of the following figure :

6



- (b) Write the incidence matrix of the following graph :

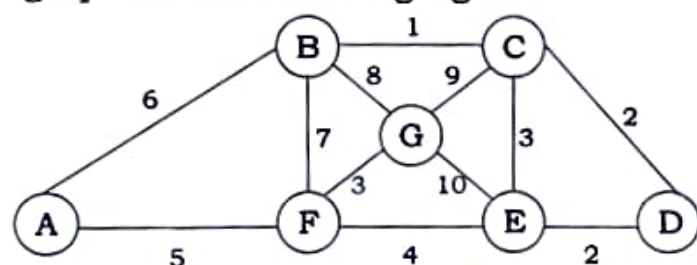
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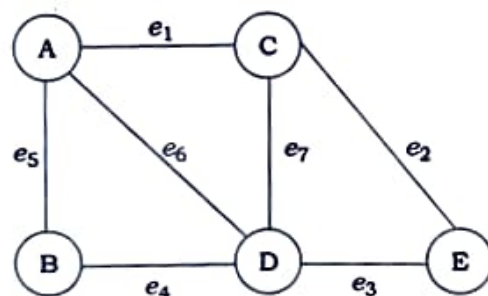
- (c) Using Kruskal's algorithm, find the minimum spanning tree for the weighted graph of the following figure :

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- (d) Write the adjacency matrix of the following graph :

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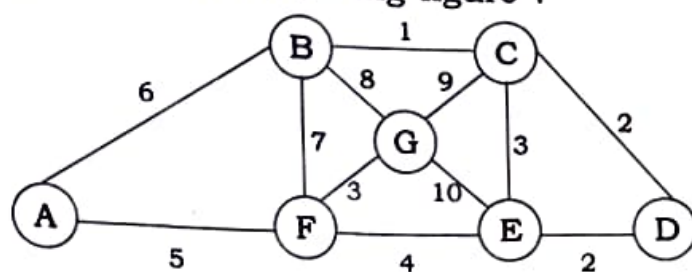
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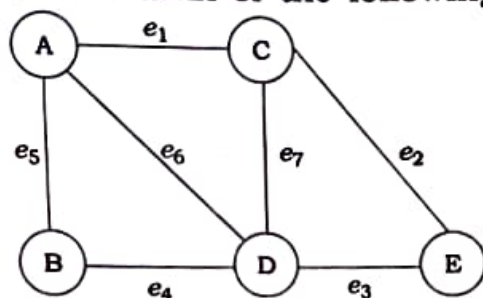
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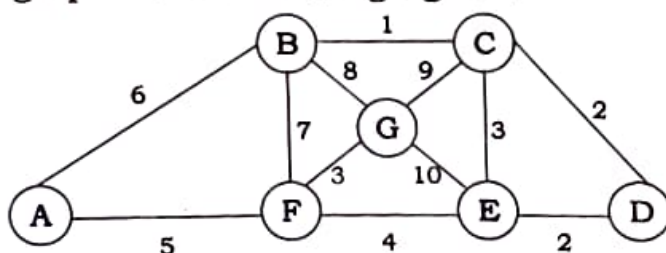
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