BCA-3/1

BCA Third Semester Examination, 2024-25

COMPUTER APPLICATION

First Paper

Discrete Structure and Group Theory

Time : 3 hours *Max. Marks : 60*

Note : Attempt all 7 questions. Section-A contains question no. 1 (comprising of very short answer type questions) which is compulsory and carries 6 marks. Section-B contains question Nos. 2, 3 & 4 which are short answer type questions and carry 6 marks each. Section-C contains question nos. 5, 6 & 7 which are long answer type questions and carry 12 marks each.

SECTION – A

1. Attempt all questions :

(a) Find the inverse of the conditional statement, "The home team wins whenever it is raining."

(b) Use an example to explain the symmetric difference operation of sets.

(c) Write the following statement in symbolic form "You cannot ride the roller coaster if you are under 4 feet tall unless you are older than 16 years old."

SECTION – B

2. Prove that

$$[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$$

is a tautology.

OR

Let X= {1, 2, ... ;7} and R = {<x, y> | x – y is divisible by 3} Show that R is an equivalence relation.

3. Show the following implication without constructing truth table :

$((PV \neg P) \rightarrow Q) \rightarrow ((PV \neg P) \rightarrow R) \Rightarrow (Q \rightarrow R)$.

OR

Write an equivalent formula for $((P \vee Q) \wedge R) \rightarrow (P \vee R)$ which contains the connectives $\wedge$ and $\neg$ only.

4. Show the validity of the following argument, for which the premises are :

$\neg J \rightarrow (M \vee N)$, $(H \vee G) \rightarrow \neg J$, $H \vee G$ and conclusion is $M \vee N$.

OR

Use a membership table to show that

$$(B - A) \cup (C - A) = (B \cup C) - A.$$

SECTION – C

5. Express the statements as logical expressions :
   (a) If a user is active, at least one network link will be available.
   (b) Some lions do not drink coffee.
   (c) Everyone is your friend and is perfect.
   (d) Not everybody is your friend or someone is not perfect.

OR

   (a) Show that

   $\exists x\, H(x) \wedge \forall x\, (H(x) \rightarrow M(x)) \Rightarrow \exists x\, M(x)$.

   (b) Find the reflexive closure, symmetric closure and transitive closure of Relation

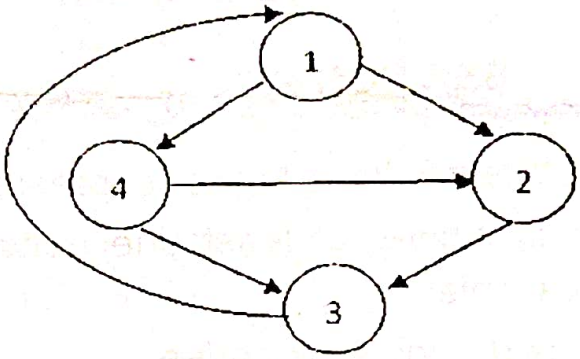
   $S = \{(4,4), (2, 2), (1,2), (3,3), (1,3)\}$ on the set $\{1, 2, 3, 4\}$.

6. Suppose that there are 1807 freshmen at your school. Of these, 453 are taking a course in computer science 567 are taking a course in

mathematics, and 299 are taking courses in both computer science and mathematics. How many are not taking a course either in computer science or in mathematics?

OR

Use Warshall's Algorithm to find the transitive closure of the following graph :



7. Write short notes on the following:
   (i) Reflexive Closure
   (ii) Quantifier
   (iii) Adjacency Matrix
   (iv) Characteristic function of a set

OR

Show that the relation R on set A is symmetric if and only if $R=R^{-1}$ where R^{-1} is inverse relation.
