TDC Even Semester Exam., 2019

COMPUTER APPLICATION

(Honours)

(2nd Semester)

Course No. : BCAC–202

(Discrete Mathematics)

Full Marks : 35
Pass Marks : 12

Time : 2 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions, selecting **one** from each Unit

UNIT—I

1. *(a)* Define converse and contrapositive of a statement. Write the converse and contrapositive of the following statement : 2+2=4

"If she works, she will earn money."

(b) Show that $(p \quad (\quad p \quad q))$ and $\quad p \quad q$ are logically equivalent. 3

2. *(a)* Write the logical terms of the following statements and then write the negation of each statement : 2+2=4

(i) "If the teacher is absent, then some students do not complete their homework."

(ii) "At least 10 inches of rainfall today in Delhi."

(b) Define universal quantifier and existential quantifier with examples. 3

UNIT—II

3. If A, B and C are any sets, then show that the following identities hold true : 2+2½+2½=7

(i) $(A \quad B) \quad A^C \quad B^C$, where A^C and B^C mean complements

(ii) $A \quad (B \quad C) \quad (A \quad B) \quad (A \quad C)$

(iii) $A \quad (B \quad C) \quad (A \quad B) \quad (A \quad C)$

4. *(a)* Let $f : R \quad R$ be a function defined as $f(x) \quad x^3 \quad 1$ and $g : R \quad R$ be another function defined as $g(x) \quad 2x^2 \quad 2$. What will be the functions, $f \circ g$ and $g \circ f$? Also find $f \circ g(2)$ and $g \circ f(3)$. 3

(b) Define one-one and onto functions. Check whether the following function is both one-one and onto or not : 4

$$f : R \quad R \text{ defined as } f(x) \quad 2x^2 \quad 3$$

UNIT—III

5. *(a)* Let $S \quad N \quad N$. Let be the operation on S defined by

$$(a, b) \ (a , b) \quad (a \quad a , b \quad b)$$

(i) Show that S is a semigroup.

(ii) Define $f : (S, \ ) \quad (z, \ )$ by $f(a, b) \quad a \quad b$. Show that f is a homomorphism. 3

(b) Show that the following four matrices form a group under matrix multiplication : 4

$$A \quad \begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix}, \ B \quad \begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix}$$

$$C \quad \begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix} \text{ and } D \quad \begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix}$$

6. *(a)* If G is a group, then prove the following : 5

(i) The identity element of G is unique.

(ii) Every $a \quad G$ has a unique inverse in G.

(iii) For every $a \quad G$, $(a^{\ 1})^{\ 1} \quad a$.

(iv) For all $a, b \quad G$, $(a \quad b)^{\ 1} \quad b^{\ 1} \ a^{\ 1}$.

(b) Explain the terms 'language' and 'regular language' in discrete mathematics with example. 2

UNIT—IV

7. *(a)* Let a be any element of a Boolean algebra B, then prove the following :

(i) If $a \quad x \quad 1$ and $a \quad x \quad 0$, then $x \quad a$

(ii) $(a\ ) \quad a$

(iii) $0 \quad 1$ and $1 \quad 0$

where all the symbols have their usual meanings in Boolean algebra. 4

(b) Write an algorithm for finding sum of products form of a Boolean expression. 3

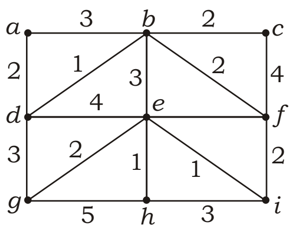
8. *(a)* Show that complements in a lattice are unique if they exist. 3

(b) Define Hasse diagram. If D_m denotes the set of divisors of m ordered by divisibility, then draw the Hasse diagram of D_{36}. 4

UNIT—V

9. *(a)* Define complete graph and bipartite graph with examples. 3

(b) Define minimum spanning tree. Find a minimum spanning tree of the following graph : 1+3=4

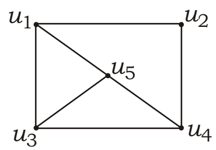


10. *(a)* Draw the undirected graphs represented by the following adjacency matrix : 1+2=3

(i) $\begin{matrix} 1 & 3 & 2 \\ 3 & 0 & 4 \\ 2 & 4 & 0 \end{matrix}$

(ii) $\begin{matrix} 1 & 2 & 0 & 1 \\ 2 & 0 & 3 & 0 \\ 0 & 3 & 1 & 1 \\ 1 & 0 & 1 & 0 \end{matrix}$

(b) Define isomorphic graphs. Check whether the following pair of graphs are isomorphic or not : 4



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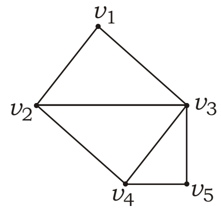

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