Total No. of Questions—5] [Total No. of Printed Pages—7

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**[5316]-3**

**F.Y. B.Sc. (Computer Science) EXAMINATION, 2018**

**MATHEMATICS**

**Paper I**

**(MTC 101 : Discrete Mathematics)**

**(2013 PATTERN)**

**Time : Three Hours** **Maximum Marks : 80**

*N.B.* :— (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Neat diagrams must be drawn wherever necessary.

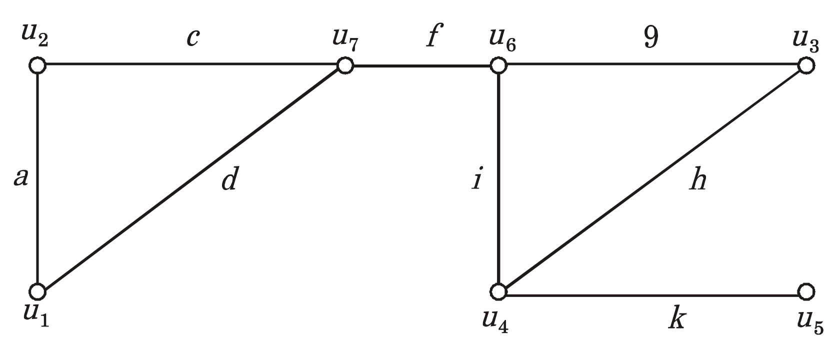
**1.** Attempt any *eight* of the following : [16]

(*i*) Write contrapositive and the converse of the following statement :

"If it is raining then the home team wins".

(*ii*) Solve the recurrence relation $a_n - 6a_{n-1} + 9a_{n-2} = 0$.

(*iii*) List a path between $u_2$ and $u_5$ of length 5 :

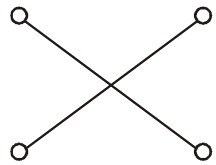



P.T.O.

(*iv*) Define : Self-complementary graph. Give *one* example.

(*v*) Show that if 7 colours are used to paint 50 cars, at least 8 cars will have the same colour.

(*vi*) Is the following Hasse diagram a lattice ? Justify :

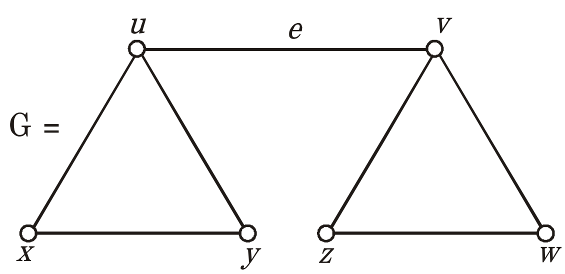


(*vii*) Prove that $p \leftrightarrow q \equiv (p \rightarrow q) \wedge (q \rightarrow p)$.

(*viii*) Define simple digraph and symmetric digraph. Give *one* example each.

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

(*x*) Find an isthmus and cut vertex of a graph :




**2.** Attempt any *four* of the following : [16]

(*i*) Let L be a complemented lattice and $a, b \in$ L, then prove that :

(1) $\overline{a \vee b} = \bar{a} \wedge \bar{b}$

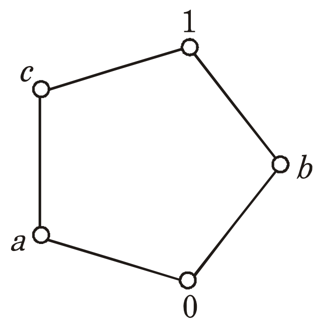
(2) $a \vee (a \wedge b) = a$.

(*ii*) Test the validity of the following argument :

$R \rightarrow C,\ S \rightarrow \sim W,\ R \vee S,\ W \vdash C.$

(*iii*) How many integers between 1 and 200 are divisible by 7 or 11 ?

(*iv*) Is the following lattice distributive ? Justify :




(*v*) Define :

(1) Universal quantifier

(2) Existential quantifier.

Let $\phi(x, y)$ denote "$x + y = 0$" and U = **R**. Write truth values of the following with justification :

(1) $\exists y \forall x \phi(x, y)$

(2) $\forall x \exists y \phi(x, y)$.

(*vi*) Give an indirect proof of "If $3n + 2$ is odd, then $n$ is odd."

**3.** Attempt any *two* of the following : [16]

(*i*) Solve the recurrence relation :

$a_n - 7a_{n-1} + 10an_{-2} = 3^r$,

given that $a_0 = 0$, $a_1 = 1$.

(*ii*) (1) In how many ways can the letters in the following word can be arranged ?

"COMPUTER"

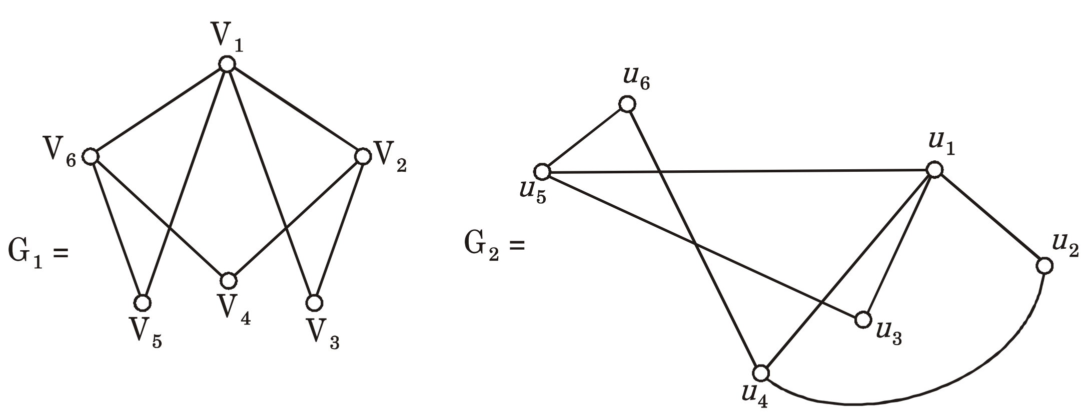
(2) How many numbers are there between 100 and 1000 in which all the digits are distinct ?

(*iii*) Simplify the following Boolean function and find disjunctive normal form of the function :

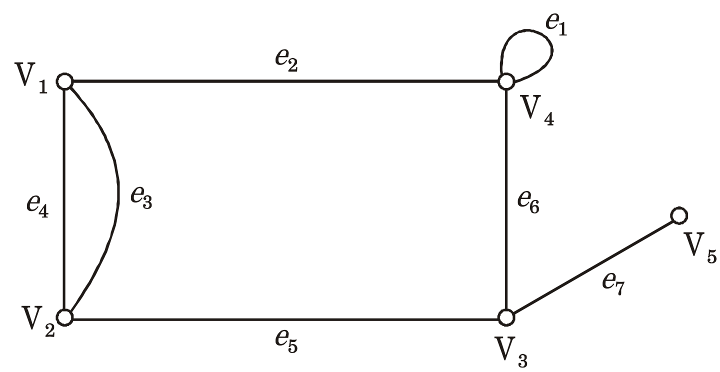
$$f(x, y, z) = (x \vee y) \vee \left[\overline{(\bar{x} \vee y \vee z)}\right].$$

**4.** Attempt any *four* of the following : [16]

(*i*) Show that the following graphs are isomorphic :



(*ii*) Find adjacency matrix and incidence matrix of the following graph :




(*iii*) Prove that every tree has *one* or *two* centres.

(*iv*) Explain Fleury's algorithm to find Euler tour in a Eulerian graph. Illustrate with an example.

(*v*) Draw the arborescence for the following expression and write it in Polish notation :

$$(5x + 8)\ (7y^3 - 2)^7.$$

(*vi*) Define the following terms :

(1) Network

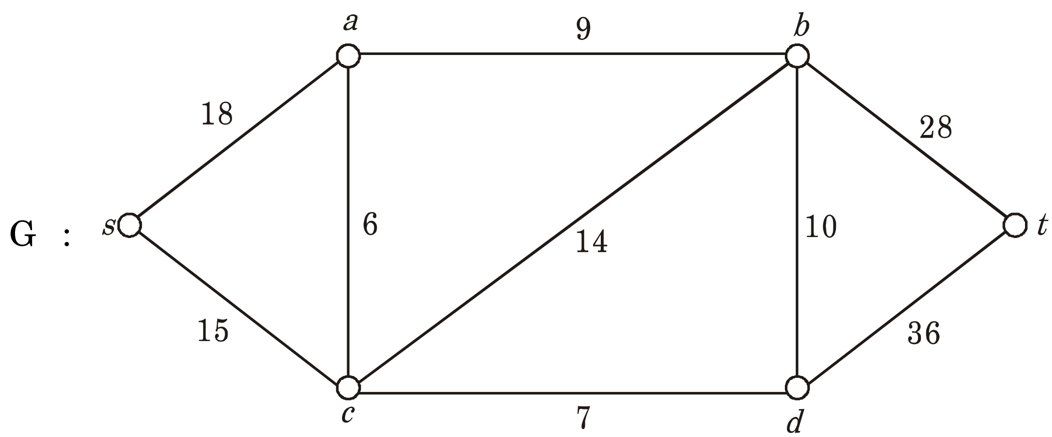
(2) Flow

(3) Value of flow

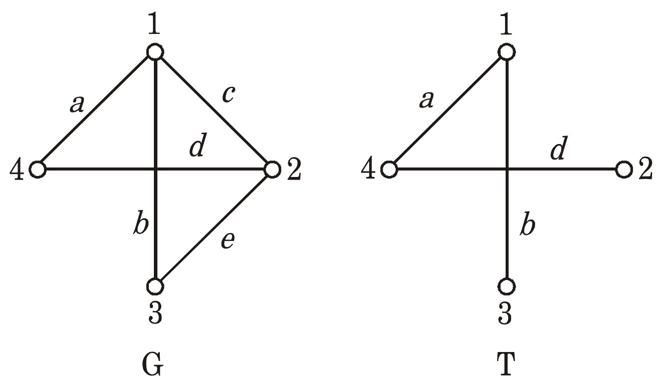
(4) Saturated edge.

**5.** Attempt any *two* of the following : [16]

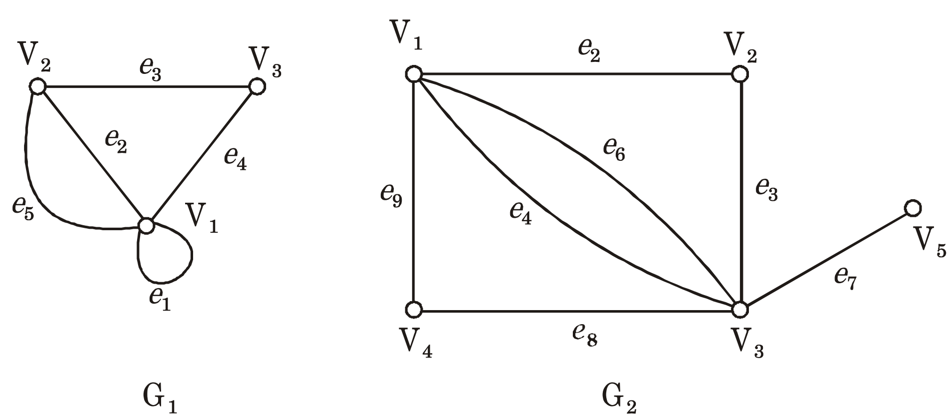
(*i*) Using Dijkstra's algorithm, find the shortest $s - t$ path in graph G :




(*ii*) Consider the graph G and its spanning tree T. Find all fundamental circuits and cut sets of G with respect to T.




(*iii*) (*a*) Find $G_1 \cup G_2$ and $G_1 \cap G_2$ of the following graphs $G_1$ and $G_2$ :



(*b*) Using Kruskal's algorithm find minimum spanning tree for the following weighted graph G :