This question paper contains 7 printed pages]

Your Roll No.....

1478

B.A./B.Sc. (Hons.)/III **A**

MATHEMATICS—Paper XVII & XVIII (III)

(Discrete Mathematics)

Time : 2 *Hours* *Maximum Marks* : 38

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt *All* the questions.

Section I

1. Attempt any *two* of the following :

(*a*) Give description of the following graph G(Fig. 1)

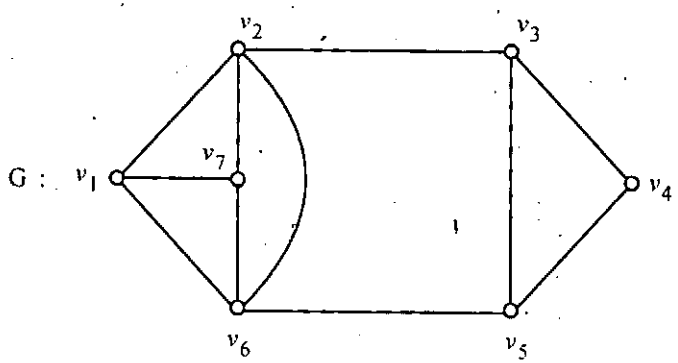

Fig. 1

Check if :

(*i*) G is connected.

P.T.O.

(*ii*) G' : V' = $\{v_1, v_2, v_4, v_6\}$

E' = $\{\{v_1, v_2\}, \{v_1, v_4\}, \{v_2, v_6\}, \{v_4, v_6\}\}$

is a subgraph of G. Justify. 3

(*b*) Show that a self-complementary graph must have 4 k or 4 k + 1 vertices. 3

(*c*) Define an Eulerian path in a graph. Find an Eulerian path in the given graph G (Fig. 2) between vertices A and B : 3

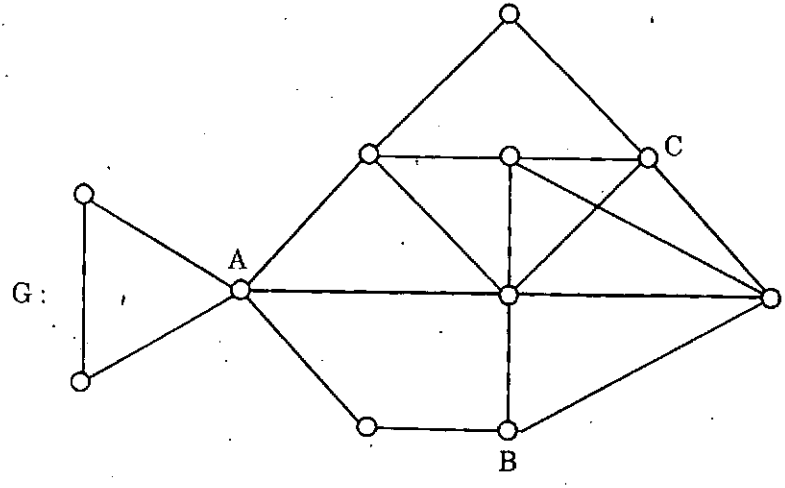

Fig. 2

2. Use nearest neighbourhood method to find a Hamiltonian circuit of minimum length for the following graph (Fig. 3), beginning at the vertex '*a*'. 3½

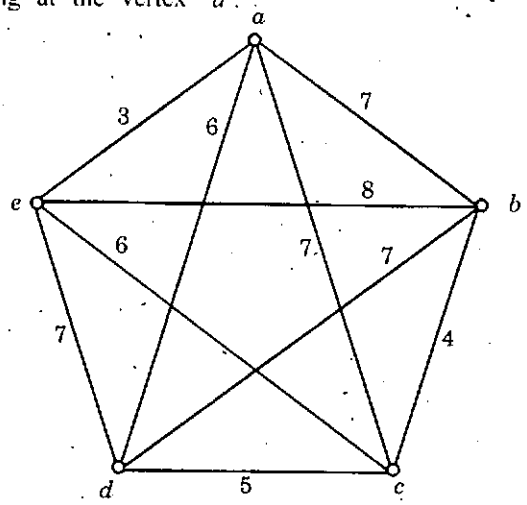

Fig. 3

Section II

3. Attempt any *two* of the following :

(*a*) Represent the following FSM in tabular form : 3

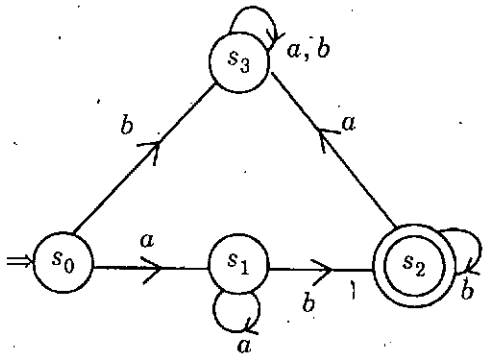

Fig. 4

Also draw the transition diagrams to find out the output sequences corresponding to the input sequences :

(*i*) *a a b a a b b a*

(*ii*) *b a a a b b b a.*

(*b*) Design a FSM with input symbols as 0, 1 and which accepts sequences having even numbers of 1's. 3

(*c*) Which type/types of strings are accepted by the following FSM : 3

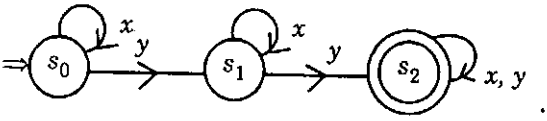

Fig. 5

4. Reduce the following FSM shown in the table, to an equivalent FSM with smallest number of states : 3½

State ↓	Input		Output ↓
	0	1	
A	B	H	0
B	F	D	0

C	A	F	0
D	A	G	0
E	D	B	1
F	C	B	1
G	D	B	1
H	C	A	0

Section III

5. Attempt any *two* of the following :

(*a*) Show that there is no (12, 8, 3, 2, 1) configuration. 3

(*b*) Show that for a (b, v, r, k, λ) configuration

(*i*) $vr(k - 1)\lambda = r^2(k - 1)^2 + r(k - 1)\lambda$

(*ii*) $(k - 1)\lambda = (k - 1)r - (v - k)\lambda$. 3

(*c*) Every particle inside a nuclear reactor splits into two particles in each second. Suppose one particle is injected

into the reactor every second beginning at $t = 0$. How many particles are there in the reactor at the nth second ? 3

6. From the seven-point plane, construct a code system of 16 words, which can detect upto 3 errors and correct upto 1 error. 3½

Section IV

7. Attempt any *two* of the following :

(*a*) Solve the recurrence relation 3

$$a_n = 4a_{n-1} - 4a_{n-2} \quad (n \geq 2)$$

$$a_0 = 1, \; a_1 = 3.$$

(*b*) Find the generating function corresponding to the discrete numeric function : 3

2, 0, 2, 0, 2, 0, ...

(c) Given that $a_0 = 0$, $a_1 = 1$, $a_2 = 4$, $a_3 = 12$, satisfy the recurrence relation :

$$a_r + c_1 a_{r-1} + c_2 a_{r-2} = 0,$$

determine a_r. 3

8. Solve the recurrence relation :

$$a_n = 4a_{n-1} - 4a_{n-2} + 4^n, \; n \geq 2$$

with initial conditions $a_0 = 2$, $a_1 = 8$. Also, obtain an expression for the corresponding generating functions. 3½