Printed Pages – 6+2=8

LR-2136

M. A./M. Sc. (Second Semester) Examination, May-June 2023

MATHEMATICS

Paper : Fifth (ii) (Optional)

(Advanced Discrete Mathematics-II)

Time Allowed : Three hours

Maximum Marks : 40

Note : *Attempt questions of all* ***two*** *sections as directed. Distribution of marks is given with sections.*

Section-'A'

(Short Answer Type Questions) **5×3=15**

Note : *Attempt all* ***five*** *questions. Each question carries 3 marks.*

1. Define Isomorphic directed graph with an example.

Or

Describe sources and types of directed graphs.

2. Design a finite state machine that perform several additions.

Or

Describe equivalent finite state machines.

3. Describe an important distinction between a deterministic and a non-deterministic acceptor.

Or

Define finite automata Mealy machine.

4. Describe partial recursive functions.

Or

Define Grammar with a phrase structure.

5. Define language generated by grammar.

Or

Explain Language Regular sets.

Section-'B'

(Long Answer Type Questions) **5×5=25**

Note : Attempt all five questions. Each question carries 5 marks.

6. The determinent of every square sub-matrix of A, the incidence matrix of a digraph is 1, –1 or 0.

Or

In a simple digraph $G=(V, E)$, every node of the digarph lies in exactly one strong component.

7. Let M be the finite state machine with given state table :

State	f		g	
	0	1	0	1
s_0	s_1	s_2	0	0
s_1	s_0	s_1	0	1
s_2	s_1	s_2	1	0
s_3	s_1	s_2	1	1

(a) Find the input set I, state set S, the output set ( ) and the initial state of M.

(b) Draw the state diagram of M.

(c) Find the output string of the input string 01001.

Or

Let x be any in a finite state machine and let x and y be any words. Then

$$f((s, x), y) = f(f(s, x), y) \text{ and}$$

$$g(s, x, y) = g(f(s, x), y)$$

8. Consider the transition diagram shown in fig.

(a) Find its states

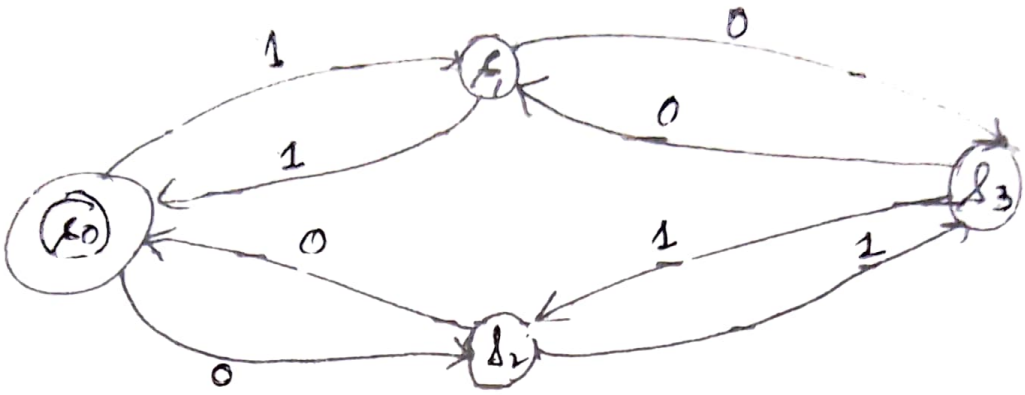
(b) Find its output symbol

(c) Find its initial state

(d) Find its accepting states

(e) Find $f(s_2, 1)$

(f) Write its next state table



Or

Find the transition diagram for the *NDFSM*, $M = (I, S, A, S_0, F)$, where

$$I = \{a, b\}, S = \{s_0, s_1, s_2\}, A = \{s_0\}$$

and the next state function f is given by table given below :

	s	t
I/S	a	b
s_0	Φ	$\{s_1, s_2\}$
s_1	$\{s_1\}$	$\{s_0, s_1\}$
s_2	$\{s_0\}$	Φ

9. Let

$$V = \{S, C\}, I = \{a, b\}, P = \{A \to aC_a,$$

$$C \to aC_a, C \to b\}$$

Find $L(G)$.

Or

Define the phase structure grammar and find the phase structure grammar that generate the set.

$$L = \{a^n, b^{2n} ;\ n \geq 1\}$$

10. Define sentential form. The language

$$L(G_n) = \{a^n\ b^n\ c^n / n \geq 1\}$$

is generated by the following grammar.

$$G_n = \langle \{S, B, C\}, \{a, b, c\}, S, \Phi \rangle$$

Where Φ consists of the productions.

Or

State and prove Kleenes theorem.