CS/B.TECH(IT)/SEM-5/CS-512/07/(08)

3



# ENGINEERING & MANAGEMENT EXAMINATIONS, DECEMBER - 2007 FORMAL LANGUAGE AND AUTOMATA THEORY SEMESTER - 5

Time: 3 Hours ]

| Full Marks: 70

#### GROUP - A

#### ( Multiple Choice Type Questions )

1. Choose the correct answer from the given alternatives:

 $10\times1=10$ 

i) Consider

	Next		
PS	X = 0	X = 1	O/P
qo	q <sup>2</sup>	q <sup>3</sup>	0
q1	$\mathbf{q}^{1}$	$\mathbf{q^2}$	1
$q^2$	q <sup>3</sup>	$\mathbf{q^2}$	1
q <sup>3</sup>	q¹	$\mathbf{q}^{\mathbf{o}}$	. 0

PS = present state.

Considering the following Moore M/C, find out the o/p string for the i/p string 1010. (where q0 is the initial state).

a) 10011

**b)** 00110

c) 10111

d) 01111.

±1) S → a ABC | a

 $A \rightarrow a A \mid B$ 

 $B \rightarrow a BA \mid C$ 

 $C \rightarrow \lambda \mid aC$ 

The null-able variables for the above grammar are

a) S, A, B, C,

b) A, B

c) S, A, C

d) A, B, C.

5



ix)	The set $A = \{a^n b^n c^n \mid n = 1, 2, 3,\}$ is an example of a grammar that		r that is		
	a)	regular	<b>b</b> )	context free	
	c)	context sensitive	d)	none of these.	
x)	The	intersection of CFL and R	egular langu	age	
	a)	is always regular	<b>b</b> )	is always context free	

d)

need not be regular.

### GROUP - B

## (Short Answer Type Questions)

Answer any three of the following.

 $3 \times 5 = 15$ 

- 2. Draw the transition diagram of a finite state automaton A that accepts the given set of strings over { a, b }.
  - a) even number of as and

both (a) and (b) above

b) exactly one b.

c)

3. Consider the following machine:

PS		NS, z	
•	x <u>= 0</u>	<u> </u>	x = 1
· A	в, о	<del></del>	D, 0
В	C, 0		C, 0
C	D, 0		A, 0
D	D, 0		A, 1

	D D; 0	
a)	Draw the testing table.	1
ъ)	Draw the testing graph.	1
<b>c</b> )	Use connection matrix to determine whether or not it has a finite memory.	2
d)	If it does, find the order of finite memory with justification.	1
Defin	ne parse tree. What is zero equivalent state?	3 + 2
a)	Prove that $(a^*ab + ba)^*a^* = (a + ab + ba)^*$	
<b>b</b> )	Show that $L = \{ w^p / p \text{ is prime } \}$ is not regular.	3 + 2
Desig	gn a CFG for the language $L = \{ a^n b^{2n} / n \ge 0 \}$ .	5
	b) c) d) Defin a) b)	<ul> <li>a) Draw the testing table.</li> <li>b) Draw the testing graph.</li> <li>c) Use connection matrix to determine whether or not it has a finite memory.</li> <li>d) If it does, find the order of finite memory with justification.</li> <li>Define parse tree. What is zero equivalent state?</li> <li>a) Prove that (a* ab + ba)* a* = (a + ab + ba)*</li> </ul>

6



#### GROUP - C

## (Long Answer Type Questions)

Answer any three questions.

 $3 \times 15 = 45$ 

- 7. i) Test whether the following machine is definite or not:
  - a) By using synchronizing tree.

2

b) By using repeated derivation of contraction tables.

2

c) If the machine is definite, what is the order of definiteness? Justifity.

PS		NS	
	x = 0	· 	x = 1
A	A		В
В	c		В
С	A		D
_	١٥		

ii) Consider the following machine:

PS		1	vs	
	I <sub>1</sub>	I <sub>2</sub>	I <sub>3</sub>	I <sub>4</sub>
A	-	· <del></del>	E, 1	_
В	C, 0	<b>A, 1</b> ,	B, 0	_
C	C, 0	D, 1		A, 0
D	<b> </b> -	E, 1 ·	<b>B,</b> - ·	_
E	B, 0		C, -	В, О

a) Draw the merger graph.

2

b) Draw the merger table.

2

c) Draw the compatibility graph.

2

find the minimal closed covering with justification.

3

8. a) Design the NFA for the language  $L = (ab \cup aba)^*$ .

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- b) Let  $G = \{V_N, V_T S, P\}$  be a phase-structure grammar, where  $V_N = \{S, B\}$ ,
  - $V_T = \{ a, b \}, P = \{ S \rightarrow aBa, B \rightarrow aBa, B \rightarrow b \}, Find L (G).$

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c) State the difference between DFA and NFA. Find the transition diagram of the NFA with the state table shown below:

$$A = \{ 0, 1 \}, S = \{ s_0, s_1, s_2 \}, F = \{ s_0 \}.$$

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N		
s		
80	ф	{ s <sub>1</sub> , s <sub>2</sub> }
s <sub>1</sub>	{ s <sub>2</sub> }	{ s <sub>0</sub> , s <sub>1</sub> }
s <sub>2</sub>	{ s <sub>o</sub> }	ф

9. Consider the machine given below:

	1	is	
PS	x = 0	x = 1	z
A	D	G	o
В	С	E	0
С	н	F	0
D.	F.	F	0
E	В .	В	0
F	G	<b>D</b> .	0
G	A	В	0
Н	E	c	1

a) Derive the closed partitions. Construct a  $\pi$ -lattice for it.

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- b) Find the state tables for the parallel components after decomposing the machine into parallel components.

  5
- c) Draw a schematic diagram of the machine with these parallel components. 5
- 10. Design a two-input, two-output sequence detector, which produces an output of1 every time the sequence 0101 is detected and an output of 0 at all other times.Draw the circuit diagram using gates.

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11. a)

PS		NS	
	x = 0		x = 1
A	B, 1		H, 1
В	F, 1	•	D, 1
C <sub>.</sub>	D, 0		E, 1
D	с, о		F, 1
E	D, 1		C, 1
F	C, 1		C, 1
G	C, 1		D, 1
н	C, 0		A, 1

Find the equivalence partitions for the machine above. Also find a standard form of the corresponding reduced machine. What is the minimum length sequence that distinguishes state A from State B?

b)

PS		NS	<del>-</del>
	<b>x</b> = 0		x = 1
A	F, 0		B, 1
В	G, 0		A, 1
С	В, 0		C, 1
D	C, 0		B, 1
E	D, 0		· A, 1
F	E, 1		<b>F</b> , 1
G	E, 1		G, 1

Find the equivalence partitions for the machine above. Also find a standard form of the corresponding reduced machine: 8 + 7

**END**