

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE - 2008 FORMAL LANGUAGE AND AUTOMATA THEORY SEMESTER - 4

Time : 3 Hours	1		[Full Marks: 70
THIC . O HOURS			1

GROUP - A

(Multiple Choice Type Questions)

Cl	100se th	he correct alternatives for the following:	10 × 1 = 10
i)		nich of the following regular expressions over { 0, 1 } denotes the ings not containing 100 as a sub-string?	e set of all
	a)	0*(1*0)* b) 0*1010*	
	c)	0*1*01* d) 0*(10+1) *.	
11)	DF	'A has	· .
-1	a)	single final state	
:	b)	more than one initial states	•
•	c)	unique path (for a set of inputs) to the final state	
	d)	all of these.	
iii) Whi	tich of the following is regular?	
	a)	Strings of 0's whose length is a perfect square	
	b)	Strings of all palindromes made up of 0's & 1's	
	/ c)	Strings of 0's, whose length is a prime number	
	d)	Strings of odd number of zeroes.	
iv)	The	e logic of pumping lemma is a good example of	
	a)	the pigeon-hole principle b) the divide & conquer techn	ique
	c)	recursion d) iteration.	

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A



v)	The class of context free language i	s not c	losed under
	a) concatenation	b)	union
	c) intersection	d)	repeated concatenation.
vi)	The grammar $G = (\{S\}, \{0,1\}, P,S)$ w	here P	={S→0S1, S→0S, S→S1, S→0} is a
•	a) recursively enumerable langu	age	
	b) regular language		
- 1 - 1 - 1 - 1 - 1	c) context sensitive language		
	d) context free language.		
vii)	If S is the number of states in NDFA	then o	equivalent DFA can have maximum of
	a) S states	b)	S-1 state
	c) 2 ⁸ states	d)	2 ^s – 1 states.
viii)	If L1 is the set of languages accepte	ed by a	NPDA and L2 is the set of context free
	languages, then		
	a) L1=L2	b)	L1CL2
•	c) L2 <u>C</u> L1	d)	None of these.
ix)		er to	the grammar given by the following
	production rules	* • * • *	
	$S \rightarrow Aa, A \rightarrow c \mid Ba, B \rightarrow abc$		
	a) zero	b)	one
	c) two	d)	three.
x)			the maximum number of states in an
	equivalent minimized DFA is at leas		
	a) n ⁰	b)	2 ⁿ
	c) n!	d)	None of these.
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GROUP - B

(Short Answer Type Questions)

Answer any three of the following.

 $3 \times 5 = .15$

- 2. a) What do you mean by a sub-tree of a derivation tree?
 - b) Consider G whose productions are S → aAS/a, A → SbA/SS/ba. Show that S → aabbaa by constructing a derivation tree, by right most derivation, whose yield is aabbaa.
- 3. Convert the Mealy Machine (given below) to a Moore Machine.

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	Next State	i/p=0	Next state	i/p=1
Present State	State	Output	State	Output
Q ₁	Q ₂	1	Q_1	0
Q ₂	Q ₃	Ō	Q ₄	1
Q ₃	Q ₁	0.9905	Q ₄	0
Q4	Q ₃	Ticl self la seul	Q_2	1

4. Reduce the following grammars to GNF:

$$S \rightarrow AO, A \rightarrow OB, B \rightarrow OA, B \rightarrow 1$$

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5. The set $L = \{a^i b^j c^k / \text{where } i, j, k \text{ are integer and } i, j, k \ge 1\}$. Is L regular? Justify your answer.



6. Minimize the following machine by determining the set of equivalent states.

Present State	Next State	i/p=0	Next state	i/p=1	
resent state	State	Output	State	Output	
A NEW AU	B - A E MAN	& sa Location	in all C or wall	0	
B	right vol. = 1 mo	e antern 0	A .	. 0	
С	B B onless of smold	0 s od I wor -1 gent	G	0	
D	G	0	A	0	
E	F	1	В	0	
F	HARR E	watuO-1 200	D	. 0	
G *	D	0	G	0	
н	F	1	В	0	

GROUP - C

(Long Answer Type Questions)

Answer any three of the following questions.

 $3 \times 15 = 45$

. a) State & discuss Myhill-Nerode theorem.

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b) Write the CFG for the language

$$L = \{0^i \ 1^j \ 2^k \mid i=j \text{ or } j=k\}.$$

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c) Prove that CFLs are not closed under intersection and complement operation.



- a) E → E+E|E*E|a. Prove that the CFG with this production rule is ambiguous.
 Remove the ambiguity from this grammar.
 - b) $S \rightarrow AB$; $A \rightarrow a$, $B \rightarrow C/b$, $C \rightarrow D$; $D \rightarrow E$, $E \rightarrow a$.

 remove the unit production.

$$L = \{a^n | b^n | n \ge 0\}$$
. Find a CFG to generate L^2 .

3 + 2

c) Design a PDA which accepts the language.

L = {
$$W \varepsilon (a,b)^* | W$$
 has equal no. of a & b}.

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- 9. a) A long sequence of input pulses enters a two-input, two-output synchronous sequential circuit, which is required to produce an output pulse Z=1, whenever a sequence 010101 occurs. Overlapping sequences are accepted. Draw the state transition diagram.
 - b) Find minimum state reduced machine containing the following incompletely specified machine.

i todnive	GET OF S	cvara in	
PS 18 11 30 210	I ₁	gandi I ₂	I ₃
A	C, 0	E, 1	des b
В	C, 0	E, -	4 (-
С	В, -	C, 0	Α, –
D	в, о	C,-	E,-
E	Later -	E, 0	A, -

I is Indicaya so \$7



10. a) Show that the following FSM is information lossless of finite order:

PS	TERMINE IN NO.	Z, Z
The Art and	x=0	x=1
A	C, 0	D, 1
В	D, 0	C, 1
C	A, 0	В, 0
D	C, 1	D, 1

Also find its order of information losslessness.

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b) Find the minimal inverse machine of the FSM in problem (a).

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11. a) What do you mean by Inverse machine? Write the definition of a lossless machine. What do you mean by Halting problem of a Turing machine? Why a Turing machine is called linear bounded Automata? 2 + 2 + 2 + 2

b) Consider the Turing machine's description is given in table below. Draw the computation sequence of the input string 00.

Present state	Tape symbol :: b	Tape symbol :: 0	Tape symbol :: 1
Q_1	1Lq ₂	ORq ₁	
Q_2	bRq ₃	OL q ₂	1LQq ₂
Q ₃ .	a examentona ga	bRq ₄	bRq ₅
Q ₄	ORq ₅	ORq4	1Rq ₄
Q ₅	OL q ₂		_

END