

Name :

Roll No. :

Invigilator's Signature :

CS / M.TECH -IT (SE) / SEM-3 / MSE-302A / 2010-11

2010-11

FORMAL LANGUAGE AND AUTOMATA THEORY

Time Allotted : 3 Hours

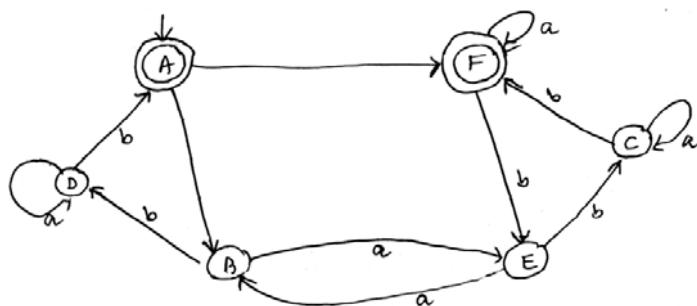
Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words
as far as practicable.

Answer any five questions. $5 \times 14 = 70$

1. a) What do you mean by K -equivalent ? Why any two final states are O -equivalent and any two non-final states are O -equivalent ?
- b) Construct the minimum state equivalent DFA for the given DFA :



- c) Find a grammar generating

$$L = \{a^n b^n c^j \mid n \geq 1, j \geq 0\} \quad (1\frac{1}{2} + 1\frac{1}{2}) + 6 + 5$$



2. a) Test whether the following machine is definite or not :

- i) By using synchronizing tree
- ii) By using repeated derivation of contraction table.

If the machine is definite, what is the order of definiteness ? Justify.

PS	NS	
	$x = 0$	$x = 1$
A	A	B
B	C	B
C	A	D
D	C	B

b) Consider the following machine :

PS	NS , Z			
	I_1	I_2	I_3	I_4
A	-	-	$E, 1$	-
B	$C, 0$	$A, 1$	$B, 0$	-
C	$C, 0$	$D, 1$	-	$A, 0$
D	-	$E, 1$	$B, -$	-
E	$B, 0$	-	$C, -$	$B, 0$

- i) Draw the merger table
- ii) Draw the merger graph
- iii) Draw the compatibility graph
- iv) Derive the minimal closed cover.

Justify.

$2 + 2 + 2 + 2 + 2 + 2 + 2$

3. a) Define Mealy machine, and Moore machine. State the differences of Moore and Mealy machines.



- b) Convert the Mealy machine to equivalent Moore machine :

PS	NS, Z	
	$x = 0$	$x = 1$
q_0	$q_1, 0$	$q_2, 0$
q_1	$q_1, 0$	$q_2, 1$
q_2	$q_2, 0$	$q_1, 1$
q_3	$q_0, 1$	$q_2, 0$

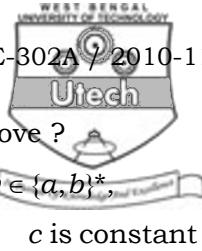
- c) Minimize the following machine :

PS	NS, Z	
	$x = 0$	$x = 1$
A	B, 0	A, 0
B	C, 0	C, 1
C	D, 0	B, 0
D	E, 0	A, 1
E	A, 0	D, 0

2 + 2 + 5 + 5

4. a) Prove that $L = \{ a^n b^n : n \neq l, n, l \geq 0 \}$ is non-regular.
- b) Design a grammar that generates $L = \{ a^n b^n : n \geq 0 \}$.
- c) Discuss pumping lemma for regular languages.
- d) Design a regular expression over $\Sigma = \{a, b\}$ with multiple of 3 numbers of a .

3 + 4 + 4 + 3



5. a) What is ID of PDA ? What is meant by move ?
 b) Design an n PDA to accept $L = \{ w c w^R : w \in \{a, b\}^*, c \text{ is constant} \}$
 c) Define n PDA. State the difference of n PDA and PDA.

(2 + 2) + 6 + (2 + 2)

6. a) Convert the grammar into equivalent CNF and GNF :

$$G = \{ (S, A, B, C), \{a, b, c\}, s, p \}$$

$$P : S \rightarrow aasbAC$$

$$A \rightarrow aAB$$

$$B \rightarrow a$$

$$A \rightarrow b$$

$$C \rightarrow cC$$

- b) Simplify the grammar :

$$G = \{ \{S, B, A, C\}, \{a, b, c\}, s, p \}$$

$$P : S \rightarrow aSBC | \lambda$$

$$B \rightarrow bB$$

$$C \rightarrow cCA$$

$$A \rightarrow \lambda$$

- c) State Myhill-Nerode theorem. 6 + 6 + 2

7. a) Construct CFG for the RE :

$$R = 0^* 1(0+1)^*$$

- b) Design a ndFA for the RE :

$$R = (ab + c^*)^* b .$$

- c) Define parse tree. What are LMD and RMD ?

Over the grammar $G = \{S, \{a, b\}, s, p\}$

$$P : S \rightarrow asbb | \lambda$$

show LMD and RMD to generate the string *aaabbbaaa*.

4 + 3 + (2 + 2 + 3)

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