Name : ……………………………………………………

Roll No. : ……………………………………………………

Invigilator's Signature : …………………………………

CS/M.Tech (CSE)/SEM-1/MTCSE-11/2012-13

2012
THEORY OF COMPUTING

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.

### GROUP – A

Answer any *five* of the following.

$5 \times 5 = 25$

1. State the pumping lemma for regular language. Prove the following language is not regular.
   $L = \left\{ a^n \ b^{n+1} \mid n \geq 1 \right\}$.

2. Minimize the following machine by partition the distinguishable states whose final states is G.

Present State	Next State	
	a	b
→A	A	D
B	C	F
C	D	E
D	A	F
E	A	G
F	B	E
G	B	D

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3. Design a CFG Language $L = \{(a\ b)^n \mid n \geq 1\}$ and convert that CFG into CNF form.

4. Find regular expression for the given diagram
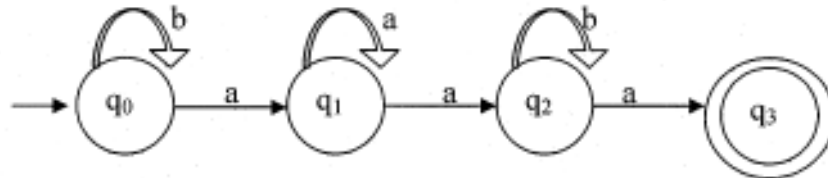
5. Construct the grammar for the language $L = \{a^m\ b^n \mid \text{where } m \neq n\}$

6. Show that the function f (n) = n ! is a primitive recursive.

7. Construct a Moore machine equivalent to the Mealy machine M given in table.

Present State	Next State			
	input = 0		input = 1	
	state	output	state	output
→ A	A	1	B	0
B	D	1	D	1
C	B	1	C	1
D	C	0	A	1

GROUP – B

Answer any *three* of the following.

$3 \times 15 = 45$

8. a) Prove the following identity :

(0*01 + 10)* 0* = (0 + 01 + 10)*

b) Construct a DFA with reduced state equivalent to the regular expression :

10 + (00 + 1) 0*10

c) Construct a regular grammar G generating the regular set represented by

R = 01 (0 + 1) *   4 + 6 + 5

9. a) Convert the following grammar into GNF

$S \rightarrow aAS \mid a$

$A \rightarrow SbA \mid SS \mid ba$

b) What are the Decidable properties of CFL's ?

c) State the Pumping Lemma for Context-Free Language.

By using pumping lemma, show that the language $L = \left\{ a^n \, b^m \mid m = n^2 \right\}$ is not a context-free language.

d) Show that the following grammar is ambiguous.

$S \rightarrow abSb \mid a \mid aAb$

$S \rightarrow bS \mid aAAb \mid ba$ 5 + 2 + 5 + 3

10. a) Define Pushdown Automata. Discuss with an example.

b) Define acceptance of input strings by PDA.

c) Design a PDA which accepts the language,
$L = \left\{ a^n \, b^n \mid n \geq 1 \right\}$

d) Construct a pda equivalent to the CFG

$S \rightarrow 0BB,$

$B \rightarrow 0S \mid IS \mid 0$

Test whether 010^4 accepted by Null Store.   2 + 2 + 5 + 6

11. a) Give formal definitions of a k-tape Turing Machine.

   b) Construct a Turing Machine that will accept all string over $L_G = \{a^n \ b^n \ c^n\}$ | where n ≥ 1 }

   c) Describe the halting problem of Turing Machine.

   3 + 9 + 3

12. a) Prove that L is a recursive language, then its complement L^{-1} is also recursive.

   b) State the properties of Recursive Language.

   c) Find the language generated by the grammar.

   $S \rightarrow abSb \mid a \mid aAb$

   $A \rightarrow bS \mid aAAb \mid ba$ 3 + 6 + 6