



Name :

Roll No. :

Invigilator's Signature :

CS/M.TECH(CSE)/SEM-1/MTCSE-11/2011-12

2011

THEORY OF COMPUTATION

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

(Short Answer Type Questions)

Answer any *five* questions.

5 × 5 = 25

1. State the pumping lemma for regular language. Prove that the following language is not regular :

$L = \{ a^{pow(i,2)} \mid i \text{ is positive integer number and } pow(x, y) \text{ returns } x^y \}.$

2. Minimize the following machine by partition of the distinguishable states. Final states are $\{ E, F \}$:

Present State	Next State	
	0	1
A	E	D
B	F	D
C	E	B
D	F	B
E	C	F
F	B	C



3. Design a CFG for a language $L = \{ a^{4n} \mid n \geq 1 \}$ and convert that CFG into CNF form.
4. Show that the following grammar is ambiguous :
 $S \rightarrow abSb \mid a \mid aAb$
 $A \rightarrow bS \mid aAAb \mid ba$
5. State the Pumping Lemma for context-free language. By using pumping lemma, show that the language $L = \{ a^p \mid p \text{ is prime} \}$ is not a context-free language.
6. Write the context-free grammar for the language :
 $L = \{ 0^i 1^j 2^k \mid i = j \text{ or } j = k \}$
7. Show that the following function is primitive recursive :
 $\text{factorial}(n) = n!$

GROUP - B

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

8. a) Prove the following identity :
 $P * + (P + Q) * QP * = P * (QP *) *$
- b) Draw the transition diagram for the given regular expression :
 $0 (1 + 010) * (10 * 1) * 10 * 1$
- c) Find the regular expression for the machine given in the table below. In this case the starting state is A and final state is D.

Present state	Next State		
	$ip = 0$	$ip = 1$	$ip = 2$
A	C	D	B
B	A	B	D
C	A	B	C
D	D	C	B

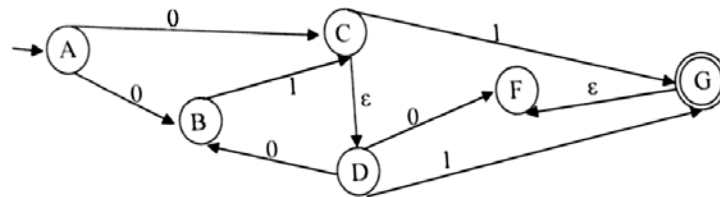
4 + 5 + 6



9. a) Define Pushdown Automata. Discuss with an example.
 b) What is ID of PDA ?
 c) Design a PDA which accepts the language,
 $L = \{ w \in \{ a, b \}^* / w \text{ has the equal numbers of } a\text{'s and } b\text{'s} \}$
 d) Let G be the grammar
 $S \rightarrow aB / ba, A \rightarrow a / aS / bAA, B \rightarrow b / bS / aBB$
 For the string $aaabbabbba$, find —
 i) leftmost derivation
 ii) rightmost derivation
 iii) parse tree. 3 + 2 + 5 + 5
10. a) Formally define
 i) a k -head Turing machine (with a single one-way infinite tape)
 ii) a configuration of such a machine
 iii) the yields in one step relation between configuration of such a machine.
 b) Design a Turing machine to recognize the language
 $\{ a^n b^n c^m \mid n, m \geq 1 \}$. 3 + 2 + 2 + 8
11. 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) Construct a pda equivalent to the CFG
 $S \rightarrow 0BB$
 $B \rightarrow 0S \mid 1S \mid 0$
 Test whether 010^4 accepted by Null Store. 5 + 3 + 7



12. a) Formally define alphabet, grammar and language.
 b) Prove the following :
 Regular set is closed under set intersection and complementation.
 c) Remove ' ϵ ' transition from the following diagram and then design equivalent DFA.



$$3 + (3 + 3) + 6$$

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