



SF-7065

B. E. - III (Sem. - VI) (CO/IT) Examination

May/June - 2011

Automata & Formal Languages

Time : 3 Hours]

[Total Marks : 100

Instruction :

नीचे दृशावेक निशानीवाणी विगतो उत्तरवडी पर अवश्य लखवी.
Fillup strictly the details of signs on your answer book.

Name of the Examination :
B. E. - 3 (SEM. - 6) (CO/IT)

Name of the Subject :
AUTOMATA AND FORMAL LANGUAGES

Subject Code No. : 7 0 6 5 Section No. (1, 2,.....): Nil

Seat No. :
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Student's Signature

- 1 (a) Do as directed. 10
- 1 Give recursive definition: The language of palindromes over Σ . 2
- 2 Give recursive definition of extended transition function δ^* for NFA - Λ . 2
- 3 Find regular expression: The language of all strings that begin or end with 00 or 11. 2
- 4 Find a string of minimum length in $\{0,1\}^*$ not in the language corresponding to the regular expression : $1^*(0+10)^*1^*$ 2
- 5 Describe language as simply as possible for the regular expression: $0^*1(0^*10^*1)^*0^*$. 2
- 1 (b) Draw FA recognizing the following languages. 10
- 1 The language of all strings containing no more than one occurrence of the string 00. (The strings 000 should be viewed as containing two occurrences of 00.) 5
- 2 The language: $\{0, 10^*, 01^*0\}$ 5
- 2 Attempt any three from the following. 15
- 1 Explain the procedure for converting the given DFA into minimum number of states DFA. 5
- 2 Enlist applications where the finite automaton is useful. 5

- 3 Languages L1 and L2 are the subsets given below. ($\Sigma = \{0, 1\}$) 5
 $L1 = \{x \mid 00 \text{ is not a substring of } x\}$
 $L2 = \{x \mid x \text{ ends with } 01\}$
 Draw FAs recognizing the following languages (i) L1 - L2 (ii) $L1 \cap L2$
- 4 Draw an FA that recognize the language of all strings of 0's and 1's of length at least 1, that if they were interpreted as binary representation of integers, would represent evenly divisible by 3. Your FA should accept the string 0, but no other strings with leading 0's. 5
- 3 Attempt following. 15
- 1 Define Pumping Lemma. 7
 Prove that the language $L = \{a^n b^k : n > k \text{ and } n \geq 0\}$ is not regular.
- 2 Consider the following NFA- Λ . 8

Q	$\delta(q, \Lambda)$	$\delta(q, 0)$	$\delta(q, 1)$
-A	{B}	{A}	\emptyset
B	{D}	{C}	\emptyset
C	\emptyset	\emptyset	{B}
+D	\emptyset	{D}	\emptyset

Convert this NFA- Λ into its equivalent NFA and then to DFA.

OR

- 2 Convert the Following Melay Machine with input $\Sigma = \{a, b\}$ and output Alphabet $\Gamma = \{0, 1\}$ into Moore machine. 8

States	After Input a		After Input b	
	New State	Output	New State	Output
-q0	q2	0	q1	1
q1	q0	0	q2	0
q2	q0	1	q2	1

- 4 A Find CFG for the following languages [Any Two] : 6
- $L = \{a^n b^{2n} \mid n \geq 0\}$
 - $L = \{a^i b^j c^k \mid j = 2i + 2k\}$
 - Language L containing string of odd palindrome over $\Sigma = \{a, b\}$

B For the following CFG's, describe the language it accepts : 6

1. $S \rightarrow XY$
 $X \rightarrow aX \mid bX \mid a$
 $Y \rightarrow Ya \mid Yb \mid a$

2. $S \rightarrow aSa \mid bSb \mid \wedge$

3. $S \rightarrow aXb \mid bXa$
 $X \rightarrow aX \mid bX \mid \wedge$

C Explain Parse Tree with suitable example. 2

5 A Attempt any TWO of the following: 10

i) Eliminate all the \wedge productions from the grammar, without changing the language generated by the grammar.

1. $S \rightarrow ABAC$
 $A \rightarrow aA \mid \wedge$
 $B \rightarrow bB \mid \wedge$
 $C \rightarrow c$

2. $S \rightarrow AaA$
 $A \rightarrow Sb \mid bCC \mid \wedge$
 $C \rightarrow CC \mid abb$

ii) Design a TM to compute 2's complement of a given binary number.

iii) Prove that "The intersection of two Context Free Languages may or may not be context free."

B Construct PDA and find CFG for the language $L = \{a^i b^j c^k \mid i, j \geq 1\}$

OR

B Construct PDA for ODD – PALINDROME.

6 A Convert the following CFG into CNF : 5

$S \rightarrow aSb \mid ab$

B Build TM to accept the language EVEN-EVEN. 8

OR

B Prove that for a given CFG that generates the language L, there is a PDA that accepts exactly L with example. 8

C Specify whether the given statements are true or false :

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1. The union of two context free language is always context free.
 2. The complement of a context free language may or may not be context free.
 3. The language EQUAL EQUAL is a regular language.
 4. The Context Free Grammars are always accepted by PDA.
 5. PDA maintains a stack for storage.
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