ONE TIME EXIT SCHEME

USN | | | | | | | | | |

10CS56

Fifth Semester B.E. Degree Examination, April 2018
Formal Languages & Automata Theory

Time: 3 hrs. Max. Marks:100

Note: *Answer FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Define the following terms, with suitable example for each:
(i) Alphabet (ii) String (iii) Language **(06 Marks)**

b. Define DFA. Design the DFA to accept strings of a's and b's ending with a substring : abb **(07 Marks)**

c. Obtain an NFA to accept strings of a's and b's with 4th position from right end is : a. Also show the moves made by NFA for the string : ababab **(07 Marks)**

2 a. Obtain the regular expressions for the following languages:
(i) $L = \{\omega : |\omega| \bmod 4 = 0, \omega \in \{a,b\}^*\}$
(ii) $L = \{\omega | 3^{rd}$ symbol from right is : a and ends with : c, $\omega \in \{a,b,c\}^*\}$ **(07 Marks)**

b. Convert the following $\in$–NFA to DFA. Refer Fig. Q2 (b) **(08 Marks)**

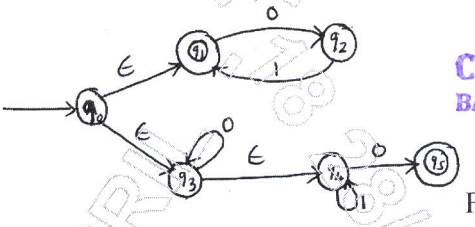

Fig. Q2 (b)

c. Convert the regular expression $(01+1)^*$ to an $\in$–NFA. **(05 Marks)**

3 a. State and prove pumping Lemma for regular languages. Prove that the language $L = \{\omega\omega^R | \omega \in \{a,b\}^*\}$ is not regular. **(08 Marks)**

b. Minimize the following DFA using table filling method: **(08 Marks)**

δ	a	b
→A	B	D
B	C	E
C	B	E
D	C	E
*E	E	E

c. Show that if L is regular language, then so is $\overline{L}$. **(04 Marks)**

4 a. Define CFG. Obtain CFG for the language:
$L = \{a^i b^j | i \neq j, i \geq 0, j \geq 0\}$ **(07 Marks)**

b. Consider the following Grammar:
$E \rightarrow E + E \mid E - E$
$E \rightarrow E * E \mid E/E$
$E \rightarrow (E) \mid id$, {where id, +, -, *, /, (,) are terminals}
(i) Obtain the left most derivation for the string : (id + id * id)
(ii) Obtain the right most derivation for the string : (id + id)*(id – id) **(08 Marks)**

4 c. What is an ambiguous grammar? Show that grammar shown below is ambiguous:

$S \rightarrow aaB \mid AB$

$A \rightarrow Aa \mid a$

$B \rightarrow b$

(05 Marks)

PART – B

5 a. Define PDA. Design PDA to accept the following language by final state:

$L = \{\omega c \omega^R \mid \omega \in \{a, b\}^*\}$. Also, show the moves made by the PDA for the string : abbcbba.

(10 Marks)

b. Convert the following CFG to PDA:

$S \rightarrow aABC$

$A \rightarrow aB \mid a$

$B \rightarrow bA \mid b$

$C \rightarrow a$

(10 Marks)

6 a. What are useless symbols? Begin with the grammar:

$S \rightarrow ABC \mid BaB$

$A \rightarrow aA \mid BaC \mid aaa$

$B \rightarrow D \mid bBb \mid a$

$C \rightarrow AC \mid CA$

$D \rightarrow E$

(i) Eliminate $\in$-productions

(ii) Eliminate any unit productions in the resulting grammar.

(iii) Eliminate any useless symbols in the resulting grammar. **(10 Marks)**

b. Obtain the following grammar in CNF.

$S \rightarrow AB \mid AC$

$A \rightarrow aA \mid bAa \mid a$

$B \rightarrow bbA \mid aB \mid AB$

$C \rightarrow aCa \mid aD$

$D \rightarrow aD \mid bC$

(10 Marks)

7 a. What is an instantaneous description of Turing Machine? Obtain a Turing machine to accept the language. Also show the moves on: 000111

$L = \{0^n 1^n \mid n \geq 1\}$ **(12 Marks)**

b. What is a multi-tape Turing machine? Show how it can be simulated using single tape Turing machine. **(08 Marks)**

8 Write short notes on:

a. Post correspondence problem.

b. Application of regular expressions.

c. Linear bounded automation.

d. Applications of CFG. **(20 Marks)**

* * * * *