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)**

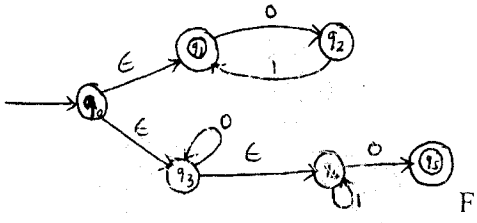

Fig. Q2 (b)

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:
$E \rightarrow E+E | E-E$
$E \rightarrow E*E | E/E$
$E \rightarrow (E) |$ 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 Mark)**

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 Mark)**

b. Convert the following CFG to PDA:
$S \rightarrow aABC$
$A \rightarrow aB \mid a$
$B \rightarrow bA \mid b$
$C \rightarrow a$ **(10 Mark)**

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 Mark)**

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 Mark)**

7 a. What is an instantaneous description of Turing Machine? Obtain a Turing machine to accep the language. Also show the moves on: 000111
$L = \{0^n 1^n \mid n \geq 1\}$ **(12 Mark)**

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

8 Write short notes on:
a. Post correspondence problem.
b. Application of regular expressions.
c. Linear bounded automation.
d. Applications of CFG. **(20 Mark)**

* * * * *