F–11981

Register No. | | | | | | | | |

BE Degree Examination November 2016

Fifth Semester

Computer Science and Engineering

14CST52 – THEORY OF COMPUTATION

(Regulations 2014)

Time: Three hours | Maximum: 100 marks

Answer all Questions

Part – A (10 × 2 = 20 marks)

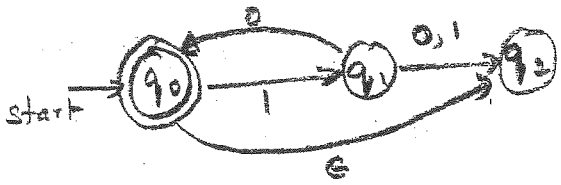
1. Consider the finite automata transition table shown below with start state and final state is $\{q_0\}$. Identify the language accepted by the finite automata using the string abba, abbbab....

State	Inputs	
s	a	b
q_0	q_2	q_1
q_1	q_3	q_0
q_2	q_0	q_3
q_3	q_1	q_2

2. Compare and contrast deterministic and non-deterministic finite automata.

3. Write the regular expression for language accepted by the NFA given.

[use state elimination method]



4. Show that the language $L = \{a^i b^j : i <= j\}$ is not regular using pumping lemma.

5. Pictorially depict how a PDA works.

6. Is the following grammar ambiguous? Justify

$S \rightarrow ibtSeS|ibtS|a$.

7. Let T be the turing machine defined by the δ functions:

$(q_0,0)$, $(q_1,1,R)$, $(q_0,1)$, $(q_1,0,R)$, (q_0,B), $(q_1,0,R)$, $(q_1,0)$, $(q_2,1,L)$, $(q_1,1)$, $(q_1,0,R)$ and (q_1,B), $(q_2,0,L)$. For each of the following initial tapes, determine the final tape when T halts, assuming that T begins in initial position of the string given

.....	0	0	1	1	1	1	.....

.....	1	1	1	1	0	0	.....

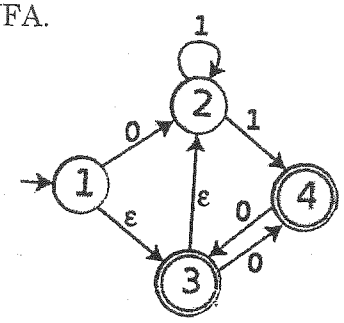
8. Define instantaneous description of TM.

9. Define recursive and recursively enumerable language.

10. When do we say a problem is decidable? Give an example.

Part – B ($5 \times 13 = 65$ marks)

11. a. i) Consider the following ε-NFA. Find the ε-closure of each state and construct its equivalent NFA. (8)



ii) Explain deductive and inductive proof with example. (5)

(OR)

b. Construct a DFA equivalent to the NFA $M = (\{a,b,c,d\},\{0,1\},\delta,a,\{b,d\})$ where δ defined as: (13)

	0	1
a	{b,d}	{b}
b	{c}	{b,c}
c	{d}	{a}
d	ϕ	{a}

12. a. i) Find all strings in $L((a+b)^* b(a+ab)^*)$ of length less than four. (3)

ii) Construct an NFA for the regular expression $(a+b)^* aab(a+b)^*$ and explain. (10)

(OR)

b. i) Construct a minimum state automaton equivalent to a given automation M whose transition table is given below: (10)

State/Input	a	b
→ q0	q0	q3
q1	q2	q5
q2	q3	q4
q3	q0	q5
q4	q0	q6
q5	q1	q4
* q6	q1	q3

ii) Show that when the regular languages L_1 and L_2 are given, the resultant languages obtained through their intersection is also regular. (3)

13. a. i) Prove that if L is $N(M_1)$ (the language accepted by empty stack) for some PDA M_1, then L is $N(M_2)$ (the language accepted by final state) for some PDA M_2. (8)

ii) Construct a PDA by empty stack to accept the given language $L = \{wCw^R \mid w \in \{a,b\}^*\}$. (5)

(OR)

b. i) Write a grammar G to recognize all prefix expressions involving all binary arithmetic operators. Construct a parse tree for the sentence "-*+abc/de" using G. (5)

ii) If L is context free language prove that there exists a PDA M, such that $L = N(M)$. (8)

14. a. i) Find the grammar in Chomsky Normal Form (CNF) equivalent to (5)

$S \rightarrow aAD \quad A \rightarrow aB \mid bAB \quad B \rightarrow b \quad D \rightarrow d$

ii) Convert the grammar $G = (\{A_1, A_2, A_3\}, \{ab\}, P, A_1)$ into Geribach Normal Form (GNF) where P consists of the following productions: (8)

$A_1 \rightarrow A_2A_3$, $A_2 \rightarrow A_3A_1 \mid b$, $A_3 \rightarrow A_1A_2 \mid a$.

(OR)

b. Design a Turing Machine (M) to implement the function MULTIPLICATION using the subroutine COPY. (13)

15. a. i) State and explain Post's Correspondence problem. (5)

ii) Show that Universal language L_u is recursively enumerable but not recursive. (8)

(OR)

b. i) Prove that the halting problem is undecidable. (8)

ii) Prove the following: (5)

"If L_1 and L_2 are recursive language then $L_1 \cup L_2$ is a recursive language".

Part – C ($1 \times 15 = 15$ marks)

16. a. Design a DFA that accepts the following language (L) over the alphabets {0,1}. Let L = {Set of all string that contains a pattern 11}. (15)

(OR)

b. Explain the class P and NP problems with suitable example. (15)