



Class: BCS - 4 A & B

Subject: CSC312 - Theory of Automata

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Total Marks: 50

Time allowed: 180 Min

Date: 10-Jan-2025

NOTE: All questions should be solved (no choice). Answers should be precise.

(CLO1) Design various kinds of automata along with interconversion among equivalent notations.

Q.1.

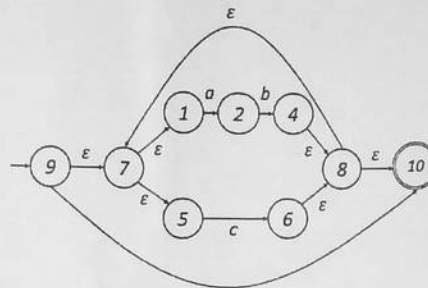
[4 Marks]

1.1 Consider an automatic washing machine that starts the washing process by pressing the start button after a coin is inserted into it. It completes one wash cycle after going through different states and returns to the original state of accepting coins for the next wash. The user can stop the machine by pressing the cancel button at any state. Design a 5-tuple Finite Automata to represent the working of this machine.

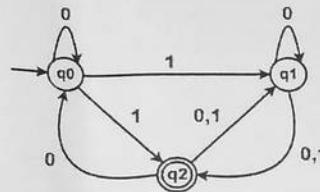
Q.2.

[2+4=6 Marks]

2.1 What is the language accepted by the following Non- Deterministic Finite Automata with epsilon.



2.2 Design the DFA after converting the following NDFA through subset construction. Write the final regular expression of DFA.



(CLO2) Construct grammar and model for different languages.

Q.3.

[3+3=6 Marks]

3.1 Given the following CFG, draw the parse tree of equation $4 + 2 * 3$.

$S \rightarrow E$

$E \rightarrow E + T \mid E - T \mid T$

$T \rightarrow T * F \mid T / F \mid F$

$F \rightarrow \text{integer} \mid (E)$

3.2 Show that the grammar with productions given below is ambiguous.

$S \rightarrow abSb \mid a \mid aAb$

$A \rightarrow bS \mid aAAb$

Q.4.

[7 Marks]

4.1 Convert the CFG with productions given below to Chomsky Normal Form (CNF) and then construct its PDA.

$S \rightarrow aSbb \mid abb$

(CLO3) Design Turing machines performing simple tasks.

[3+5+4=12 Marks]

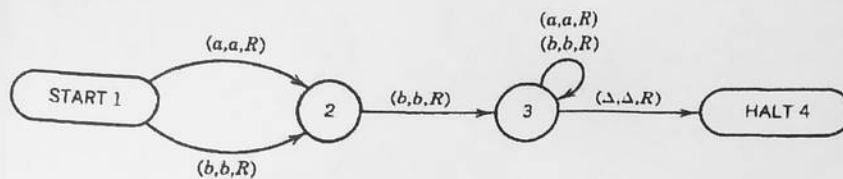
Q.5.

5.1 Design an even-even Turing Machine that accepts strings having even number of a 's and b 's.

5.2 Assemble a Turing Machine from the following summary table and state its language.

From	To	Read	Write	Move
START 1	2			R
2	2	a	A	R
2	2	a	a	R
2	2	B	B	R
2	3	b	B	L
3	3	B	B	L
3	4	a	a	L
3	5	A	A	R
4	4	a	a	L
4	1	A	A	R
5	5	B	B	R
5	HALT	Δ	Δ	R

5.3 Make a summary table for the following Turing Machine.

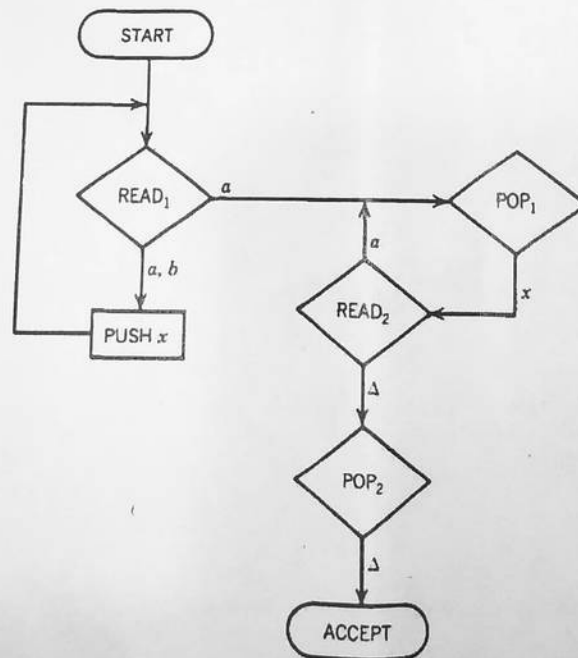


(CLO4) Describe the role of abstract computational models to define which computational problems are solvable and which are not.

Q.6.

[3+4+2+2=11 Marks]

Consider the following Non Deterministic Push Down Automata (NPDA):



- 6.1 Show that the word aa can be accepted by this PDA by demonstrating a trace of its path to ACCEPT.
- 6.2 Show that the word $babaaa$ can be accepted by this PDA by demonstrating a trace of its path indicating exactly where we must take the branch from $READ_1$ to $READ_2$.
- 6.3 Show that the string $babaaab$ cannot be accepted.
- 6.4 Show that the string $babaaaa$ cannot be accepted.

Q.7.

[4 Marks]

7.1 Prove that:

$$abcabc \in L((a + b + c)^* a (a + b + c)^*)$$

END