



ESA(Model Pape)– B. TECH. (CSE) – IV Sem

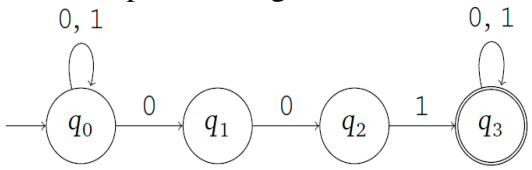
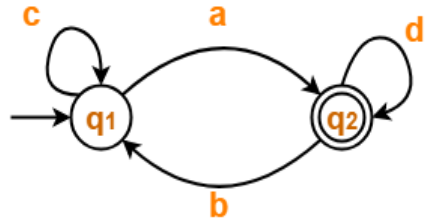
April 2020

UE18CS254 – Theory of Computation

Time: 3 Hrs

Answer All Questions

Max Marks: 100

1	a.	Consider the problem of determining if a string is an integer in the following format: an optional minus sign followed by at least one digit. Design a finite automaton for this problem.	04
	b.	Construct A DFA over the alphabet $\{0,1\}^*$ for the language of strings of length at least two that begin and end with the same symbol.	06
	c.	Construct An NFA over the alphabet $\{0,1\}^*$ for the language of strings that contain either a number of 0's that's even or a number of 1's that's even.	04
	d.	Consider the following NFA, There are three possible sequences of states that this NFA could go through while reading all of the string 001001. What are they? Does the NFA accept this string? 	06
2.	a.	Give regular expression for The language of strings that contain a number of 1's that's a multiple of k .	02
	b.	Give regular expressions for the language of strings that contain at least k 1's. Do this in general, for every $k \geq 0$.	04
	c.	Convert the following DFA to Regular expression . 	04
	d.	Find a regular expression for the language recognized by this machine, Show all your work, in particular, the state diagrams after the removal.	08

		<pre> graph LR Start(()) --> A((A)) A -- "0,1" --> B((B)) B -- "0,1" --> A A -- "0,1" --> C(((C))) C -- "1" --> B C -- "0" --> C </pre>	
	e	List the operations that the regular languages are closed under .	02
3	a.	Let $L_1 = \{w \in \{0,1,2\}^* : w \text{ contains more 0's than 1's.}\}$ Give a transition diagram for a PDA to recognize L_1 .	06
	b.	Let $L_2 = \{w \in \{0,1,2\}^* : w \text{ has same number of 1's and 2's.}\}$ Give a CFG to generate L_2 .	04
	c.	State whether or not $L_1 \cap L_2$ from the above question a and b is context-free. Justify your answer carefully.	06
	d.	Construct a PDA for the following language Odd palindromes wcw^R over $\{a, b, c\}$ where $w = (a + b)^*$.	04
4	a.	Use the Pumping lemma to show that the language $\{a^i b^j c^k \mid i \leq j \leq k\}$ is not context free . The alphabet is $\{a, b, c\}$.	08
	b.	List the operations that the Context free languages are closed under.	02
	c.	Convert the following grammar to Chomsky Normal Form.	04
	d.	Convert the following grammar to Greibach Normal Form. $S \rightarrow AB, A \rightarrow aA \mid bB \mid b, B \rightarrow b$	04
	e.	Convert the following grammar to Greibach Normal Form. $S \rightarrow aSb \mid ab$	02
5	a.	Design a Turing Machine that accepts the following language. $L = \{ab(a + b)^*\}$	04
	b.	Let $L_5 = \{a^i b^j c^k \mid 0 \leq i \leq j \leq k\}$. Describe a Turing Machine that decides L_5 .	08
	c.	How would one simulate a PDA on a Turing machine? Please do not write the Turing machine itself, but rather write the key idea in plain English.	08