SUBJECT CODE: 102405CS

B.Tech.- 4th Semester Examination April-May 2022

Specialization: Theory of Computation

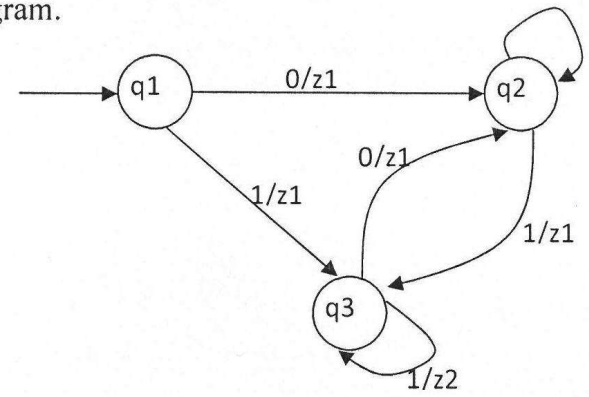
Course: B.TECH

Maximum Marks: 100

Time Allowed: 3 Hours

Minimum Pass Marks: 35

Note: Attempt all questions. Part A of each question is compulsory and carries 4 marks; attempt any two parts from B, C and D carrying 8 marks.

Q. No.		Question	Marks
1	A	Differentiate between DFA and NFA.	4
	B	Explain Moore and Mealy Machine. Construct Moore machine which is equivalent to the Mealy machine given in the diagram. 	8
	C	Construct equivalent DFA for NFA M= ({p , q, r, s}, {0,1}, δ, p, {s}), where δ is given below: → p: 0 → p, q; 1 → p q: 0 → r; 1 → r r: 0 → s; 1 → -- (s): 0 → s; 1 → s	8
	D	State and prove Myhill-Nerode theorem	8
2	A	Write the regular expression 1. Any string formed using {0,1} with 1 as the fourth symbol from the end. 2. first character 'a' or 'c' followed by any string in 'b'. 3. All strings of a's and b's ending in aa.	4

		4. The set of strings containing ab as a substring	
	B	For the following regular expressions, draw the corresponding finite automata: (i) (0+1)*0(0+11)* (ii) 10+(0+11)0*1	8
	C	List the identities of regular expressions. State and prove Arden's theorem.	8
	D	Give the statement of pumping lemma. List its applications. Using pumping Lemma prove that the language $\{0^n1^n \mid n\geq 0\}$ is not regular.	8
3	A	Consider production rules of a CFG : S→ bA/aB, A→ aS/aAA/a, B→ bS/aBB/b. Find leftmost and rightmost derivations for string w=aaabbabbba	4
	B	Define GNF. Construct a grammar in Greibach normal form equivalent to $S \rightarrow YY \mid 0,\ Y \rightarrow SS \mid 1.$	8
	C	Explain Chomsky classification of languages by giving example and discuss the relation between the classes of these languages.	8
	D	Reduce the following grammar to Chomsky Normal Form : S→ 1A |0 B, A→ 1AA | 0S|0, B→ 0BB |1S |1	8
4	A	Design a PDA M to accept the language $L=\{0^n1^{n+2} \mid n\geq 1\}$	4
	B	Trace the sequence of moves made for each of the input strings bbcbb and baca for the PDA for the grammar S→ aSa/bSb/c	8
	C	What is Instaneous Description? What are moves made by the Turing Machine in the processing of the string. i) 00 ii) 0101	8

		<table><tr><th>Present State</th><th colspan="3">Tape Symbol</th></tr><tr><td></td><td>b</td><td>0</td><td>1</td></tr><tr><td>→q1</td><td>1Lq2</td><td>0Rq1</td><td>--</td></tr><tr><td>q2</td><td>bRq3</td><td>0Lq2</td><td>1Lq2</td></tr><tr><td>q3</td><td>---</td><td>bRq4</td><td>bRq5</td></tr><tr><td>q4</td><td>0Rq5</td><td>0Rq4</td><td>1Rq4</td></tr><tr><td>q5</td><td>0Lq2</td><td>--</td><td>--</td></tr></table>	
	D	Write short notes on (i) Universal Turing Machine (ii) Church's Hypothesis	8
5	A	Explain space and time complexity theory.	4
	B	State and explain Post correspondence problem. List its applications. Find the solution to the instance of PCP given in Table. <table><tr><td>i</td><td>x_i</td><td>y_i</td></tr><tr><td>1</td><td>0</td><td>000</td></tr><tr><td>2</td><td>01000</td><td>01</td></tr><tr><td>3</td><td>01</td><td>1</td></tr></table>	8
	C	What are decidable and undecidable problem. Give the properties of recursive and recursively enumerable language.	8
	D	Ackermann's function is defined by $A(0, y) = y+1$ $A(x+1, 0) = A(x, 1)$ $A(x+1, y+1) = A(x, A(x+1, y))$ A(x, y) can be computed for every (x, y) and hence A(x, y) is total. Ackermann's function is not primitive but recursive. Compute A(1,1), A(2,1),A(1,2),A(2,2).	8