Thapar Institute of Engineering and Technology, Patiala

Department of Computer Science and Engineering

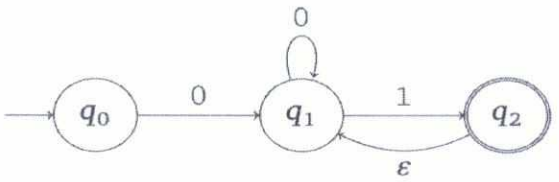
B E- COE, CSE (3rd Year) Auxiliary	Course Code: UCS701 Course Name: Theory of Computation
Time: 2 Hours, M. Marks: **50**	Faculty Name: Dr. Avadh Kishor

Note: All questions are compulsory. Assume missing data, if any, suitably.

Q1(a) Construct a DFA for the language of strings whose digits add to a multiple of 3 ($\sum = \{0,1,2,\cdots,9\}$) (5)

Q1(b) Consider the language $L = \{w \in \{0,1\}^* | \text{next-to-last symbol of } w \text{ is } 0\}$. Write a regular expression for L and convert the regular expression into NFA (using Thompson's construction). (2+3)

Q2(a) Convert the following NFA into DFA (5)



Q2(b) Show that the language $\{0^n 1^{2n+5} | n \geq 0\}$ is not regular. (5)

Q3 (a) Design a Moore machine for detecting a sequence 1010 where overlapping sequences are also accepted. (5)

Q3(b) i. Give a CFG for the language $\{a^n b a^m | m = 2n, n \geq 0\}$. The alphabet is $\{a, b\}$. (2+3)

ii. What is an ambiguous grammar? Explain with example.

Q4(a) Convert the following grammar into CNF (5)

$$S \rightarrow bA/aB$$
$$A \rightarrow bAA/aS/a$$
$$B \rightarrow aBB/bS/a$$

Q4(b) Define concept and working of PDA. Justify the argument that "NPDA is more power than DPDA" (you can take suitable example to explain). (2+3)

Q5(a) Consider a Turing machine M that accepts the language $\{a^n b^n | n \geq 1\}$. Show an instantaneous description for M while accepting the string "aaabbb". (5)

Q5(b) Describe the basic model of the Turing machine, including its formal definition, and describe three features of the Turing machine that make it more powerful than the PDA. (2+3)