Manarat International University (MIU)

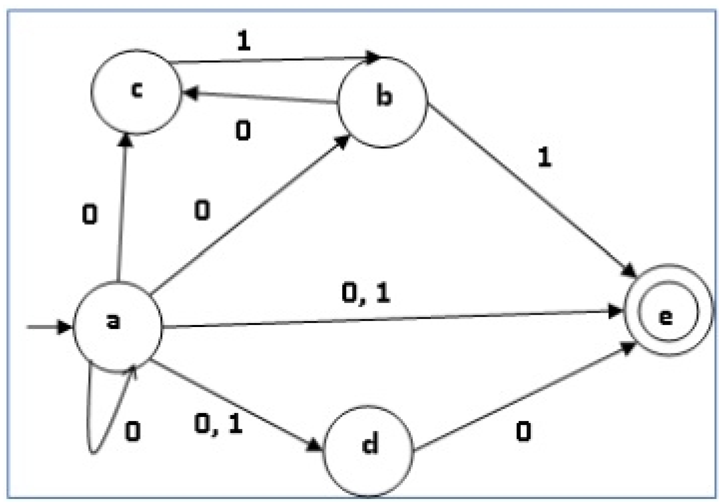
Department of CSE (Evening)

Final Exam (Summer 2017)

Theory of Computing (CSE-203)

Full Marks: 50 | Time: 2.5 Hour

<table>
<tr><td colspan="2">Answer any 5 (five) question. All questions are of equal value.</td><td></td></tr>
<tr><td>1.</td><td>a. Explain different types of grammers and the type of their accepted languages.
b. Write down the formal definition of Melay and Moore machine.
c. Construct context free grammars to accept the following languages. $\Sigma = \{0, 1\}$
i. $L = \{0^n 1^n \mid n > 0\} \cup \{0^n 1^{2n} \mid n>0\}$
ii. $L = \{ a^n b^m c^m d^{2n} \mid n \geq 0, m > 0\}$</td><td>2
2
6</td></tr>
<tr><td>2</td><td>a. Convert the following NDFA to DFA



b. Explain DFA Minimization using Equivalence Theorem.</td><td>5

5</td></tr>
<tr><td>3.</td><td>a. Write down the formal definition of pushdown automata.
b. Construct deterministic pushdown automata to accept the following languages.
i. $\{10^n 1^n \mid n>0\} \cup \{110^n 1^{2n} \mid n>0\}$
ii. $L = \{a^n b^n c^m \mid n, m \geq 1 \}$
iii. Binary strings that contain an equal number of 1s and 0s</td><td>1
9</td></tr>
<tr><td>4.</td><td>a. Define Decidable and Undecidable problems. Give some examples of Undecidable problems.</td><td>3</td></tr>
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	b. Given a regular language **L** and string **w**, how can we check if **w** $\in$ **L**? c. Show that the following language on $\Sigma = \{a, b, c\}$ is not context-free using pumping lemma. $L = \{a^n b^j c^k \mid k = jn\}$.	2 5
5.	a. Prove that *any context-free language is generated by a context-free grammar in Chomsky normal form.* b. Convert the following CFG into CNF $S \to ASA \mid aB,$ $A \to B \mid S,$ $B \to b \mid \varepsilon$	5 5
6.	a. Write down the formal definition of *Turing machine*. b. Construct a Turing machines that accepts the following languages on the alphabet {a, b}. i. $L = \{a^n b^n c^n \mid n \geq 1\}$ ii. $L = \{ ww^R \mid w \in (a, b)^+ \}$	2 8