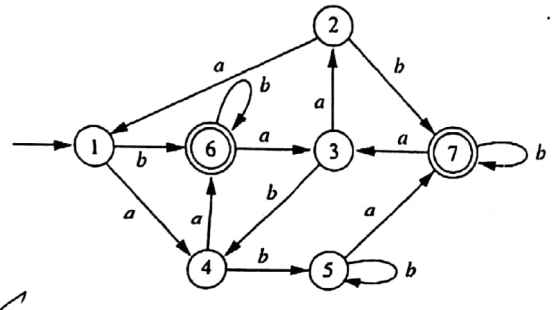
Minor Exam
Master of Computer Applications
MCAC 303: Automata Theory
Unique Paper Code: 223401303
Year of admission: 2021

Time: One Hour **Max. Marks: 30**

Instructions:

1. All questions carry equal marks.
2. Notations have their usual meaning.
3. Assume $\Sigma = \{a, b\}$ as the underlying alphabet unless mentioned otherwise.

1. Construct a minimum state finite automaton equivalent to the following finite automaton:



2. Construct regular expression and the corresponding finite automaton (FA) for the language: $L = \{w \in \Sigma^* \text{ and } |w| > 0$: w ends with $\boldsymbol{b}$ and does not contain the substring **aa**$\}$.

3. Using pumping lemma, show that the language $\boldsymbol{L}$: $\{\boldsymbol{a^{n+m}b^mc^n}$; **m, n >= 1**$\}$, is not regular over the alphabet $\Sigma = \{a, b, c\}$.

4. Show the step-wise construction of Non-deterministic Finite Automaton (NFA) for the regular expression $\boldsymbol{ba + (a + bb)a^*b}$. Also, convert the above NFA to corresponding Deterministic Finite Automaton (DFA).

5. For languages $\mathbf{L_1}$ and $\mathbf{L_2}$ described by the corresponding regular expressions $\mathbf{(ab^*)^*}$ and $\mathbf{b(a + b)^*}$, construct the following a) DFA for $\mathbf{L_1}$ and $\mathbf{L_2}$ and b) DFA that defines $\mathbf{L_1 \cap L_2}$.

6. *Design a deterministic pushdown automaton* (DPDA) for the language $\boldsymbol{L}$: $\{\mathbf{b^n c\, a^n}: \boldsymbol{n \geq 1}\}$. *Show the trace of the constructed* DPDA on a string $\boldsymbol{bbbcaaa}$.