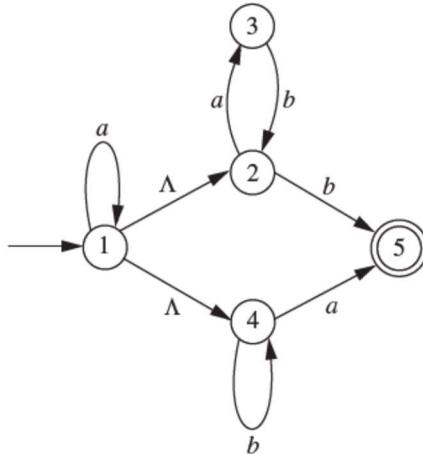


MC304 Theory of Computation

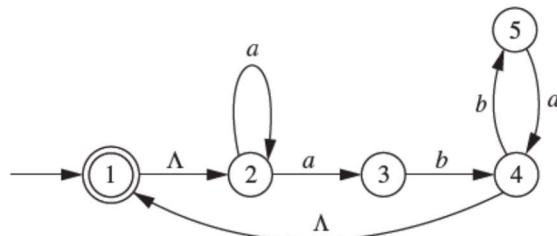
Assignment-II

1. Represent the following sets by regular expressions:
 - (a) $\{a^2, a^5, a^8, \dots\}$
 - (b) $\{a^n \mid n \text{ is divisible by 2 or 3 or } n=5\}$
 - (c) The set of all strings over $\{a, b\}$ beginning and ending with a.
2. Show that the language $L = \{vwv : v, w \in \{a, b\}^*, |v| = 2\}$ is regular.
3. Find a regular expression for the language $L = \{w \in \{0, 1\}^* : w \text{ has no pair of consecutive zeros}\}$.
4. Prove the identity:

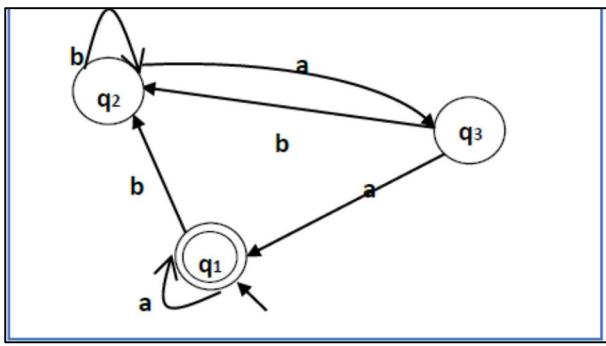
$$(a^*ab + ba)^*a^* = (a + ab + ba)^*$$
5. Show that the language $L = \{awa : w \in \{a, b\}^*\}$ is regular.
6. Convert the given NDFA with empty moves to a DFA without empty moves:



7. Eliminate empty moves in the transition diagram below:



8. Construct a regular expression corresponding to the automata given below:



9. Find context-free grammars for the following languages (with $n \geq 0, m \geq 0$).

- (a) $L = \{a^n b^m : n \neq m\}$
- (b) $L = \{a^n b^m : 2n \leq m \leq 3n\}$
- (c) $L = \{w \in \{a, b\}^* : n_a(w) = 2n_b(w) + 1\}$, where $n_a(w)$ represents number of a's in the string w.

10. Reduce the following grammars to Chomsky Normal Form.

- (a) $S \rightarrow 1A|0B, A \rightarrow 1AA|0S|0, B \rightarrow 0BB|1S|1$
- (b) $S \rightarrow a|b|cSS$

11. Reduce the following grammars to Greibach Normal Form.

- (a) $S \rightarrow SS|0S1|01$
- (b) $S \rightarrow AB, A \rightarrow BSB|BB|b, B \rightarrow aAb|a$

12. Show that the following grammars are ambiguous.

- (a) $S \rightarrow a|abSb|aAb, A \rightarrow bS|aAAb$
- (b) $S \rightarrow aB|ab, A \rightarrow aAB|a|, B \rightarrow ABb|b$

13. Use Pumping lemma to show that following are not context free languages:

- (a) $\{a^{n^2} | n \geq 1\}$
- (b) $\{a^m b^m c^n | m \leq n \leq 2m\}$