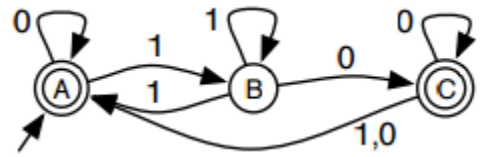
ADDIS ABABA SCIENCE AND TECHNOLOGY UNIVERSITY
DEPARTMENT OF SOFTWARE ENGINEERING

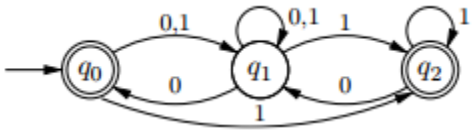
Worksheet 1

1. Decide which of the following statements is TRUE and which is FALSE. You must give a brief explanation of your answer.
   a. If L1 is regular and L2 is non-regular, then L1 · L2 is non-regular.
   b. If L1 is regular and L2 is non-regular, then L1 ∩ L2 is regular.
   c. If L1 is regular and L2 is non-regular, then L1 ∪ L2 is non-regular.
   d. There exists a language L such that L is not regular but L^* is regular.
2. Show that for any languages A and B,
   a. (Au B)* = A* (BA*)*.
   b. A*(A+B)* = (A+BA*)*.
   c. $(BA)^+(A^*B^* + A^*) = (BA)^*BA^+B^*$.
3. Construct an equivalent DFA for a given NDFA. (Use each and every steps of the algorithm you should follow.

   A.



   B.



4. Find a regular expression for the set of binary strings which have at least one occurrence of the substring 001.
5. Find a regular expression for the set of binary strings which have no substring 001.
6. Construct an equivalent DFA for regular expressions obtained from question 4 and 5 using Thompson's Construction.
7. Construct a Push Down Automata (PDA) accepting $\{a^n b^m a^n \mid m, n \geq 1\}$ by empty store. PDA = $(\{q_0, q_1\}, \{a, b\}, \{a, z_0\}, \delta, q0, z_0, \emptyset)$ where δ is given by

(1) $\delta(q_0, a, z_0) = \{(q_0, a\, z_0)\}$
(2) $\delta(q_0, a, a) = \{(q_0, aa)\}$
(3) $\delta(q_0, b, a) = \{(q_1, a)\}$
(4) $\delta(q_1, b, a) = \{(q_1, a)\}$
(5) $\delta(q_1, a, a) = \{(q_1, \lambda)\}$
(6) $\delta(q_1, \lambda, z_0) = \{(q_1, \lambda)\}$

8.