CS341 Automata Theory
Discussion Session Worksheet 2

Let M = (K, Σ, Δ, s, F) be an NFA, where
K = $\{q_0, q_1, q_2\}$, Σ = {a, b, c, d}
$\Delta = \{(q_0, a, q_0), (q_0, \varepsilon, q_1), (q_1, b, q_1), (q_1, c, q_1), (q_1, \varepsilon, q_2), (q_2, d, q_2)\}$
$s = q_0$, $F = \{q_0, q_1, q_2\}$

1. The regular expression that corresponds to the language accepted by *M* is:
   a. (abcd)*
   b. a*b*c*d*
   c. (aUbUcUd)*
   d. a*(bUc)*d*
   e. none of a-d

2. The ε-closure of q_0, $E(q_0)$ is:
   a. $\{q_0\}$
   b. $\{q_0, q_1, q_2\}$
   c. $\{q_1, q_2\}$
   d. $\{q_0, q_1\}$
   e. none of a-d

3. The ε-closure of q_1, $E(q_1)$ is:
   a. $\{q_1\}$
   b. $\{q_0, q_1, q_2\}$
   c. $\{q_1, q_2\}$
   d. $\{q_0, q_1\}$
   e. none of a-d

4. The ε-closure of q_2, $E(q_2)$ is:
   a. $\{q_2\}$
   b. $\{q_0, q_1, q_2\}$
   c. $\{q_1, q_2\}$
   d. $\{q_0, q_1\}$
   e. none of a-d

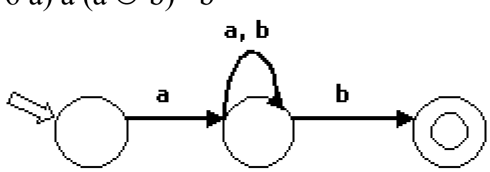
5. Let C be a configuration of M s.t. $(q_0, abcd) \vdash_M^* C$. C could be:

   a. (q_0, cd)
   b. (q_1, d)
   c. (q_0, d)
   d. (q_1, ε)
   e. (q_0, ε)

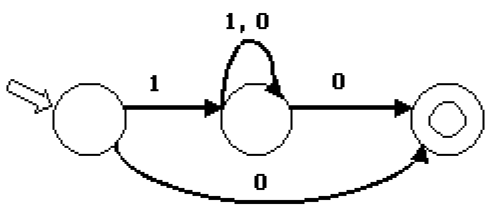
6. Construct finite state machines for the following expressions:
   a) $a (a \cup b)^* b$
   b) $1 (1 \cup 0)^* 0 \cup 0$
   c) $0^* 1 0^*$
   d) $(0 \cup 1)^* 1 (0 \cup 1)^*$
   e) $0^* (1 \cup \in) 0^*$
   f) $((0 \cup 1) (0 \cup 1) (0 \cup 1))^*$
   g) $a (a \cup b)^* a \cup b (a \cup b)^* b \cup a \cup b$

Answers: 1. d, 2. b, 3. c, 4. a, 5. b

6 a) $a (a \cup b)^* b$

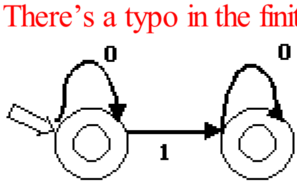


b) $1 (1 \cup 0)^* 0 \cup 0$



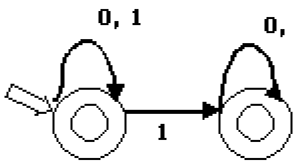
c) $0^* 1 0^*$

There's a typo in the finite state machine below, the start state should not be a final state!



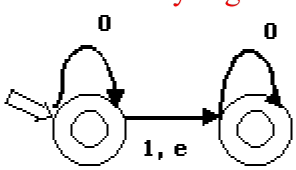
d) $(0 \cup 1)^* \; 1 \; (0 \cup 1)^*$

There's a typo in the finite state machine below, the start state should not be a final state!

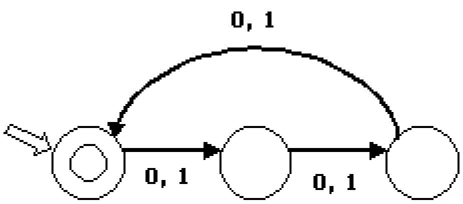


e) $0^* \; (1 \cup \in) \; 0^*$

In this case, it doesn't matter if the start state is a final state or not because $0^* \in 0^*$ is just 0^*, which is what you get from the first final state.



f) $((0 \cup 1) \; (0 \cup 1) \; (0 \cup 1))^*$



g) $a \; (a \cup b)^* \; a \cup b \; (a \cup b)^* \; b \cup a \cup b$