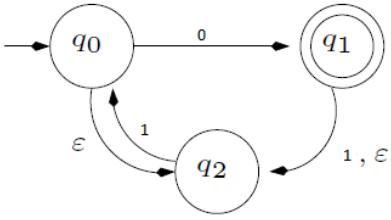
Assignment 2

Due at 2:00 PM on Friday, October 14th

1. (5 marks)

   Give a DFA that accepts the same language as the NFA below by using subset-construction. Mark clearly which subset corresponds to which state. You may omit states in the subset-construction that cannot be reached from the start-state.



2. (10 marks) Convert the following regular expressions to an NFA with ϵ-transitions:

   (a) $(0+1)01$

   (b) $00(0+1)^*$

3. (30 marks) If a language is regular, then either give a DFA, NFA or ϵ-NFA accepting it or give a regular expression for the language. If a language is not regular, then *prove* it using the Pumping Lemma.

   (a) $L = \{0^{2^n} : n \geq 0\}$.

   (b) $L = \{L$ is the binary representation of a multiple of $2\}$

   (c) L is the set of strings of 0s and 1s whose length is a perfect square.

   (d) $L = \{0^i 1^j 0^k : i > j > k\}$

   (e) $L = \{xx^R : x \in \{0,1\}^+\}$. x^R, called the *reversal* of x, is defined to be the string x read in reverse; thus $\epsilon^R = \epsilon$ and $(a_1 a_2 \ldots a_n)^R = a_n a_{n-1} \ldots a_1$.

   (f) $L = \{xwx^R : x, w \in \{0,1\}^+\}$.

4. (15 marks) For each of the following statements, say whether it is true or false. Justify your answer.

   (a) If L_1 is regular and L_2 is not regular, then $L_1 \cup L_2$ is not regular.

   (b) If L is a language, and there exists a finite language L_1 such that $L \cup L_1 = \{0^i 1^i : i \geq 0\}$, then L is not regular.