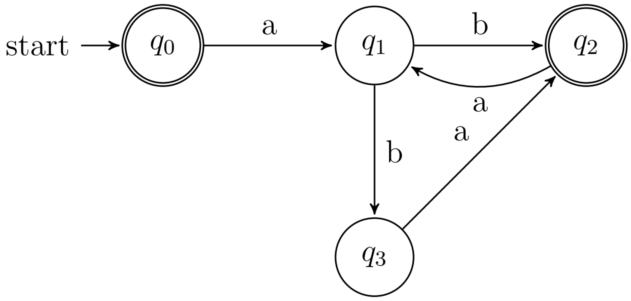
NOTE: Please upload your solutions as a single pdf file.

MATH 4LT/6LT3 Assignment #2

Due: Friday, 3 October by 11:59pm.

1. Consider the following NFA:



   Convert this NFA into an equivalent DFA using the procedure provided in the proof of Theorem 1.3.20. **Note**: You may disregard any states in the construction that cannot be reached from the initial state. So your solution should have far fewer than 16 states.

2. Show that each of the following languages is not regular:

   (a) $L_0 = \{0^n 1^n 2^n \mid n \geq 0\}$.

   (b) $L_1 = \{www \mid w \in \{a, b\}^*\}$.

   (c) $L_2 = \{a^m b^n \mid m \neq n\}$.

   (d) $L_3 = \{x = y + z \mid |x| = |y| + |z| \text{ for } x, y, z \in \{1\}^*\}$. L_3 is a language over the alphabet $\{1, =, +\}$.

3. Let Σ be an alphabet and $w \in \Sigma^*$. If $w = a_1 a_2 \ldots a_k$ for some $k \geq 0$ and $a_i \in \Sigma$, define the reverse of w to be the string $w^r = a_k a_{k-1} \ldots a_2 a_1$. Show that if L is a regular language, then so is $L^r = \{w^r \mid w \in L\}$.

4. Exercise 1.9.7.

5. Exercise 1.9.21.

The following questions are for students enrolled in MATH 6LT3. Students in MATH 4LT3 can treat them as bonus questions.

B1 For L_1 and L_2 languages over the alphabet Σ, define $L_1 \wr L_2$ to be the language

$$\{w \in \Sigma^* \mid w = a_1 b_1 a_2 b_2 \dots a_k b_k \text{ for some } k \geq 0,\ a_1 a_2 \dots a_k \in L_1$$
$$\text{and } b_1 b_2 \dots b_k \in L_2\}.$$

Prove that if L_1 and L_2 are regular then so is $L_1 \wr L_2$.

B2 Exercise 1.9.40.