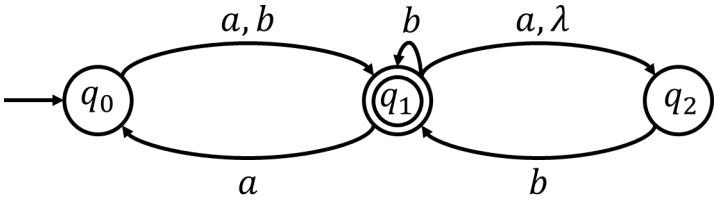
Homework 2
Max Points: 60

Directions: Answer each of the questions to the best of your ability. Make sure to show your work in order to receive potential FULL credit. Just stating the answer will result in point deductions (and possibly no credit for the respective problem) and that cannot be disputed through the grade dispute policy. Your answers must typed up and submitted as a PDF. Handwritten solutions will not be accepted.

1. (15 points) Convert the following NFA to its equivalent DFA using the procedure learned in class that produces all possible states. You may assume that $\Sigma = \{a, b\}$. From your resulting picture, which states are unreachable based on the possibilities from the DFA?



2. (15 points) In the C programming language, a value can be designated as a character type through a declaration statement where the prefix starts with `char` and ends with the suffix `;`. Between the prefix and suffix is the name of the variable. Let C be the language of valid character declaration statements. A member of C must start with `char` and end with `;`. The member must have at least 2 characters in its variable name and cannot contain the `;` character. For example, the statement `char nums;` is valid since `nums` has 4 characters, but `char x;` is not valid since `x` is only one character. For simplicity, assume that the alphabet for C is $\Sigma = \{a, b, c, d, e, h, i, r, ;\}$. Give a regular expression that generates C. You **cannot** use the set difference when creating your regular expression. Please write out the possible set of symbols that can be generated.

3. (15 points) Let A and B be regular languages. We define the following operation **PSHUFFLE**.

   PSHUFFLE(A,B) $= \{w \mid w = a_1b_1...a_kb_k$, where $a_1...a_k \in A$ and $b_1...b_k \in B$, each $a_i, b_i \in \Sigma\}$.

   Show that the class of regular languages is closed under **PSHUFFLE**. You will need to write out a proof. Hint, use a proof by construction technique.

4. (15 points) Convert the DFA into a Regular Expression using the GNFA procedure learned in class. Make sure to show your work/reasoning when performing the repair procedure in order to receive potential credit. Assume that $\Sigma = \{a, b\}$. Please do not worry about simplifying your regular expression in the final answer.