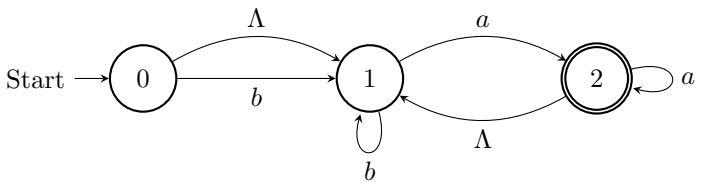
CS 291 Exam 3 April 23, 2021

Name: _____

1. (20 points) Convert the following NFA to a DFA. Show your work. Show both the DFA table AND the graph of the resulting DFA.



2. (10 points) Given the grammar: $S \rightarrow ba|aSb$

   (a) Show a parse tree for the string $aababb$

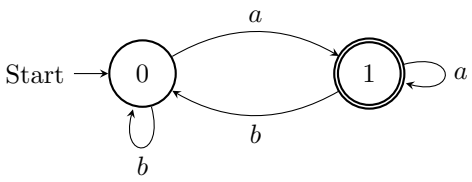
   (b) Is this the only parse tree for this string? If yes, say so. If no, show another parse tree.

3. (15 points) Find a regular expression for each of the following languages over the alphabet $\{a, b, c\}$.
   (a) $\{a^m bbc^n | m, n \in \mathbb{N}\}$

   (b) Strings over $\{a, b\}$ containing the substring bbb.

4. (15 points) Draw a graphical picture of a DFA to recognize the language:
   (a) $a^*cb^* + ab$

5. (15 points) Find a regular expression for the language accepted by the following DFA. Do so by first eliminating state 1, then eliminating state 0. Show your work:



6. (15 points) Find a grammar for each of the following languages:

(a) $\{aaabbb, aaaabbbb, ...\} = \{a^n b^n | n > 2\}$

(b) $\{ba, bbba, ..., b^{2n+1}a, ...\} = \{b^{2n+1}a | n \in \mathbb{N}\}$

7. (10 points) Show that the following grammar is ambiguous by finding a string in the language with two different parse trees. Show the two different parse trees.

   (a) $S \rightarrow b|SaS$