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: $S \rightarrow aaa|aSb$

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

(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 b^n c^o | m, n, o \in \mathbb{N}\}

(b) Strings over \{a, b\} containing the substring \textit{abb}.
4. (15 points) Draw a graphical picture of a DFA to recognize the language:

(a) $a^*abc^* + acb$
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) \( \{aaccbb, aaacbbb, \ldots \} = \{a^ncb^n|n > 1\} \)

(b) \( \{ab, aaab, \ldots, a^{2n+1}b, \ldots \} = \{a^{2n+1}b|n \in \mathbb{N}\} \)
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) \( S \rightarrow b | SaS \)