This assignment asks you to prepare written answers to questions on regular languages, finite automata, and lexical analysis. Each of the questions has a short answer. You may discuss this assignment with other students and work on the problems together. However, your write-up should be your own individual work. Assignments can be submitted electronically as a PDF by 11:00 AM PDT on scoryst.com. Please enroll in Scoryst using https://scoryst.com/enroll/ltkgbu1udy/. A LaTeX template for writing your solutions is available on course website. There is a post on Piazza describing how to create high quality DFA diagrams.

1. Write regular expressions for the following languages over the alphabet $\Sigma = \{a, b\}$:
   
   (a) The set of all strings ending with $aab$.
   
   (b) The set of all strings with three consecutive $a$’s.
   
   (c) The set of all strings which do not contain the substring $bab$.

2. Draw DFA’s for each of the languages from question 1.

3. Consider the following deterministic finite automaton (DFA) over the alphabet $\Sigma = \{0, 1\}$.

   ![DFA Diagram]

   Give a one-sentence description of the language recognized by the DFA. Write a regular expression for this language.

4. Let $L$ be the language over $\Sigma = \{0, 1\}$ such that every string in $L$ contains a pair of 0’s that are separated by a string whose length is $3i + 1$, for some $i \geq 0$. Draw a non-deterministic finite automaton (NFA) for $L$. Give an upper bound on the number of states in the corresponding DFA.
5. For each of the following specifications written in Flex, give a regular expression describing the language of possible outputs. Assume that all inputs are strings consisting of characters a, b, A, and B.

(a) Specification 1:

```
[bB][bB]   { printf("w"); }
[aA]      { printf("x"); }
[aA][aA]   { printf("y"); }
[bB]      { printf("z"); }
```

(b) Specification 2:

```
([bB]+)([aA]*) { printf("x"); }
[aA]      { printf("y"); }
[bB]      { printf("z"); }
```