COSC 341 – Assignment 1

Due: Wednesday, March 26, 11:59 p.m.

Instructions: Please submit a PDF file of your solutions via Blackboard. Marks for each question are indicated in parentheses, e.g. (**0**). The total number of marks are 10, and this assignment is worth 10% of your final mark.

Even if a question only seems to ask for an answer e.g., "How many ...", an explanation of the reason that the answer is correct is also required.

1. Let n be a positive integer, and let Σ be an alphabet containing k symbols. How many different DFAs are there over the alphabet Σ with state set $\{0, 1, 2, \ldots, n-1\}$ and initial state 0? (**1**)

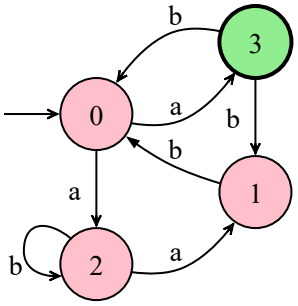
2. Let $k > 2$ be a positive integer, and let Σ be the alphabet $\{0, 1, 2, \ldots, k-1\}$. Consider the language $L \subseteq \Sigma^*$ consisting of all those strings such that no consecutive pair of letters differ by 1 modulo k (so, e.g., $k-1$ cannot be immediately followed, nor preceded by 0 or $k-2$).

   - Is this language regular? (**1**)
   - For a positive integer n, how many strings of length n are there in L? (**1**)

3. Let L be the language over $\Sigma = \{a, b\}$ of strings containing an even number of a's and not containing consecutive b's.

   - Construct a DFA that accepts L. (**1**)
   - From the previous question, describe an NFA with the same set of states that accepts L^* (note the "$*$"). (**0, not a typo**)
   - Convert that NFA to a DFA. (**2**)

4. Consider the NFA below:



   Starting from a version of this NFA in standard form, illustrate the use of the state elimination technique to produce a regular expression for the language accepted by this NFA. (**2**)

5. Let $\Sigma = \{a, b\}$ and consider the language $L \subseteq \Sigma^*$ consisting of all those strings containing three consecutive a's. What are the suffix-equivalence classes for L? (**2**)