## Assignment B - Regular Languages 2

*Reminder of the recommended approach to best prepare you for success (on exams and in future courses):*

1. Attempt each of the primary activities without reference to others' solutions or use of an automated computational tool (e.g., JFLAP).
2. Develop a solution and a set of data that helps validate the solution.
3. After you have deemed a solution satisfactory, implement that solution in JFLAP where appropriate and use JFLAP's features to analyze and test your work.
4. Clean up or annotate your solution as necessary for submission.

B1. Let Σ = { 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 } and let L1 ⊆ Σ\* be the set of decimal representations for nonnegative integers (without any leading 0s) divisible by 2. For example, 0, 2, 8, 144 ∈ L1, but 1, 02, 127 ∉ L1.

B1Prep1. Prove that L1 is regular by constructing a DFA that recognizes L1. (No submission)

B1Prep2. Construct a two-state GNFA for L1. (No submission)

B1a. Implement the DFA for L1 in JFLAP and upload it as a file named b1dfa.jff

B1r. Use Online Text to report observations about your learning associated with constructing the two-state GNFA.

B2. Let Σ = { 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 } and let L2 ⊆ Σ\* be the set of decimal representations for nonnegative integers (without any leading 0s) divisible by 3. For example, 0, 3, 9, 261 ∈ L2, but 1, 09, 127 ∉ L2.

B2Prep1. Prove that L2 is regular by constructing a DFA that recognizes L1. (No submission)

B2Prep2. Construct a RE for L2. (No submission)

B2a. Implement the DFA for L2 in JFLAP and upload it as a file named b2dfa.jff

B2b. Implement that RE in JFLAP and upload the it as a file named b2re.jff

B2r. Use Online Text to report observations about your learning associated with constructing the regular expression.

B3. Let Σ = { 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 } and let L3 ⊆ Σ\* be the set of decimal representations for nonnegative integers (without any leading 0s) divisible by 2 or 3. For example, 0, 2, 9, 144 ∈ L3, but 1, 03, 127 ∉ L3.

B3Prep1. Prove that L3 is regular by constructing a DFA that recognizes L3. (No submission)

B3Prep2. Construct a right-linear grammar for L3 with start symbol S. (No submission)

B3a. Implement the DFA for L3 in JFLAP and upload that DFA as a file named b3dfa.jff

B3b. Implement the right-linear grammar for L3 with start symbol S in JFLAP and upload that grammar as a file named b3rg.jff

B3r. Use Online text to describe insights you gain through having constructed the regular grammar.

B4. Using Online Text, show that language L4 = { wabw : w ∈ {a,b}\* } is not regular.

B5. Let Σ = { ( , ) }, that is, the set of left-parenthesis and right-parenthesis symbols. Let L5 be the set of all balanced strings in Σ\* such that

1. the number of left parentheses is equal to the number of right parentheses, and
2. the number of left parentheses in any prefix of a balanced string is no smaller than the number of right parentheses in that prefix.

Note that this is equivalent to the string comprised only of parenthesis characters derived from a legal arithmetic expression after removing all variables, numbers, and operators.

Using Online Text, show that language L5 is not regular.

B45r. Use Online Text to share your reflection on attempts to prove that languages are not regular.