Due:Sept 26

1. Give regular expressions that describe each of the following languages

   (a) L_1 = {w: w is a numerical constant that may include a fractional part and/or a positive or negative sign} over the alphabet $\Sigma = \{+, -, ., 0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$.
   The following are examples of strings in this language: 110, 3.76, +10, +1., -.05, -10.

   (b) L_2 = {w: every even position of w is an a} over the alphabet $\Sigma = \{a, b\}$.
   The following are examples of strings in this language: b, ba, baaa, babab.

2. Convert the following regular expression $0^*1^*0^+$ to an equivalent NFA using the conversion process seen in class.

3. For each of the following languages, determine if the language is regular or not. If the language *is* regular, demonstrate its regularity by either writing a regular expression which accepts the language, or drawing an NFA which accepts the language. If the language *is not* regular, **prove** that is not regular.

   (a) $L_1 = \{0^i 1^j : i, j \geq 0 \text{ and } 5i < j\}$

   (b) The language of strings over the alphabet $\{0, 1\}$ of the form $0^i 1^j$ where $(i \bmod 2) + 1 = j \bmod 3$. Examples of strings in this language include:1, 011111, 0000011.

   (c) The language of strings over the alphabet $\{0\}$ of the form 0^i where $\exists k.i = k^2$ (*i.e.*, sequences of 0s where the number of

0s is a perfect square). Examples of strings in this language include:ϵ, 0000, 0000000000000000.

4. **implementation** You can find the description and the sample input files on Canvas under Assignments $\rightarrow$ Programming Assignments $\rightarrow$ DFA1. Submit the programming assignment to Gradescope.