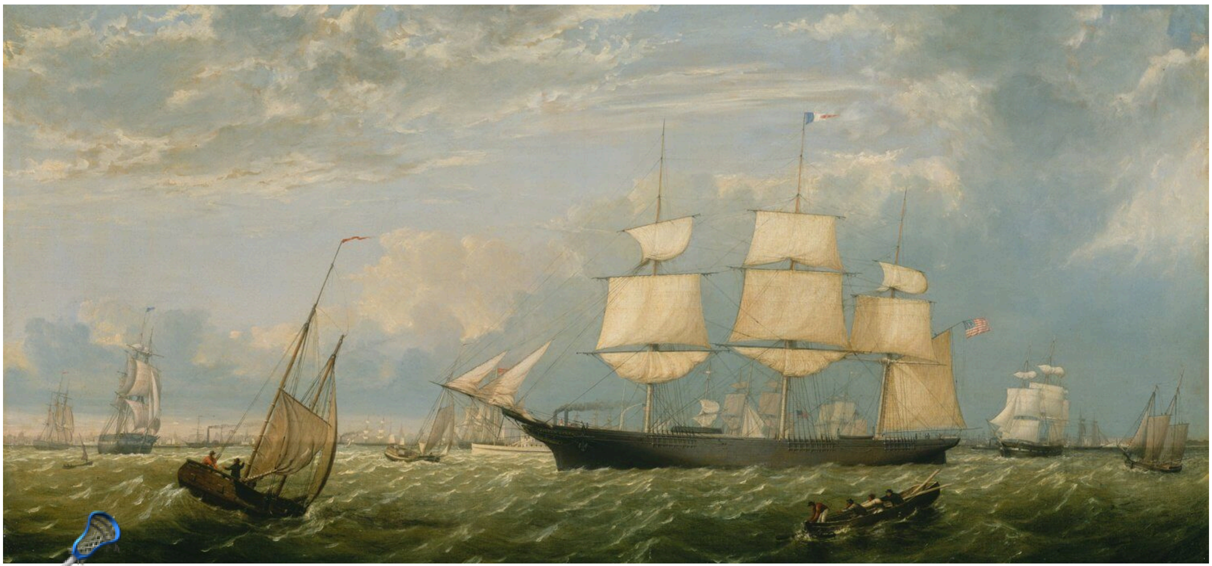
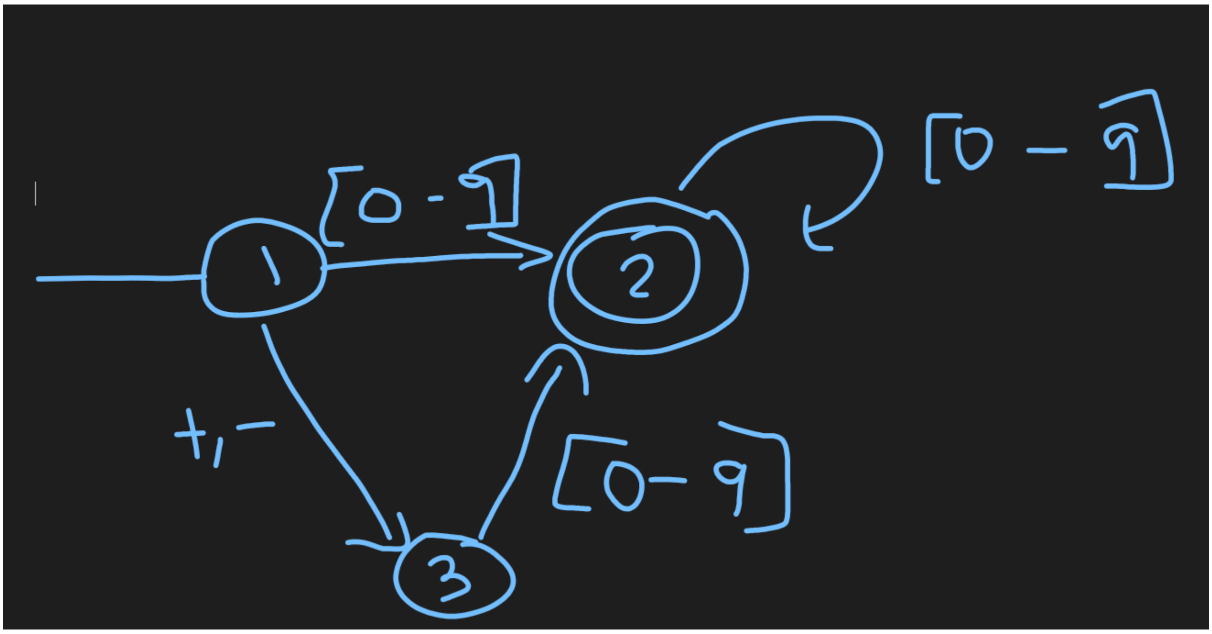


Assignment 1

1. $[+-]?[0-9]+$



3. Ok we are trying to prove that the language L of balanced field assignments is non-regular

   <u>**Statement:**</u>

   1. for the balanced field assignments to be regular, an automaton must be able to represent it

2. Both the left hand side and right hand side of the expression must be equal for it to be in the right form for the language
3. Since an automata has a limited number of states, it cannot store the length of A {which could be any length} and compare it to another string {which could also be any length}

Proof:

1. If we define a set:
   a. $\{this.a^n = a^n | n \in \mathbb{N}\}$
   b. This defines an infinite set of strings 'a' of varying length because the natural number set is countably infinite
   c. Now we assume that there is an automaton to represent this set
   d. To represent every single element in the set the automaton would need to assign a separate state for an infinite amount of strings of all different lengths
   e. The automaton can only keep track of a finite amount of states, which corresponds to a finite amount of strings, but the set $\mathbb{N}$ is infinite, so the automaton would have to track an infinite amount of states
   f. This is impossible so therefore forms a contradiction
   g. Therefore we reject our assumption
   h. Therefore no automaton can represent this set
   i. Since we have proven no automaton can represent this set, and the set represents the language L, the language L is non-regular

Proof 2:

1. If we define a set:
   a. $\{this.a^n = a^n | n \in \mathbb{N}\}$
   b. This defines an infinite set of strings 'a' of varying length because the natural number set is countably infinite
2. We define a string $x = this.a^y$
3. We define another string $z = this.a^b$

4. x and z are distinct if $y \neq b$
5. If we define a relation like:
    a. $R : a \neq b$
    b. Then if we say xRz
6. For each distinct value of y and b, a separate equivalence class is formed.
7. Since y and $b \in \mathbb{N}$, they can both take infinitely many values
8. This means there are infinite equivalence classes
9. Since each equivalence classes maps to a distinct state in an automaton, there would need to be infinite states
10. This is impossible
11. Therefore no automaton can represent this set
12. Since we have proven no automaton can represent this set, and the set represents the language L, the language L is non-regular