Prework 4.1a: Decidable Languages

Write your preliminary solutions to each problem and submit a PDF on Canvas. The names in brackets indicate the subset responsible for presenting the problem.

1. [Allie, Levi, Ben, Andrew] Let $X_1 = \{\langle A \rangle \mid A \text{ is a DFA and } L(A) = \{0,1\}^*\}$. Show that X_1 is decidable.
2. [Ky, Curtis, Connor, Micah] Let $X_2 = \{\langle A, B \rangle \mid A, B \text{ are DFA's and } L(A) \subseteq L(B)\}$. Show that X_2 is decidable.
3. [David, Meghan, Todd, Grace, Joshua] Consider the following grammar.

$$\begin{aligned} S &\to UV \\ V &\to VV \\ U &\to WU \\ U &\to \mathtt{a} \\ V &\to \mathtt{b} \\ W &\to \mathtt{c} \end{aligned}$$

   a. Explain why the derivation of any string of length n derived by this grammar requires exactly $2n-1$ steps.
   b. Simplify the grammar into an equivalent grammar with as few rules as possible.

BEGIN YOUR SOLUTIONS BELOW THIS LINE