Homework #5

Name: Suprabhat Rijal
HU ID: @03060000

Problem 4.13

Given:
$A = \{ \langle R, S \rangle \mid R$ and S are regular expressions and $L(R) \subseteq L(S) \}$

To prove: A is decidable

Here,
$$L(R) \subseteq L(S) \longleftrightarrow L(R) \cap \overline{L(S)} = \phi$$

Proof:

TM_1 = "On input $\langle R, S \rangle$ where R & S are regular expressions:

1. Convert regular expressions R and S to DFAs A and B respectively.

2. Create DFA C for $L(C)$ s.t. it accepts $\overline{L(B)}$

3. Construct DFA D for $L(D)$ s.t $L(D) = L(A) \cap L(C)$

4. Run T.M. that decides E_{DFA} on $\langle D \rangle$. If it accepts, accept. If it rejects, reject.

Date
Page

Problem 4.1b

Given:

$A = \{ \langle R \rangle \mid R$ is a regular expression describing a language containing at least one string w that has 111 as a substring $\}$

To prove: A is decidable.

~~Assuming~~

Assuming Σ is the alpabet for R

TM_2 = "On input $\langle R \rangle$ where R is a regular expression

1. Convert R into a DFA A.

2. Construct DFA B s.t it accepts language $L(B) = \{ w$ s.t. w has the substring $111 \}$

3. Construct a DFA C s.t. it describes $L(C) = L(S) \cap L(R)$

4. Run T.M. that decides E_{DFA} on $\langle C \rangle$. If it accepts, reject. If it rejects, accept.