Assignment 7
Computer Science 235

Reading. Sections 4.1 and 4.2

1) Consider the problem of determining whether a DFA and a regular expression are equivalent. Express this problem as a language and show that it is decidable.

2) Let $A_{\varepsilon_{\text{CFG}}} = \{<G> \mid G \text{ is a CFG that generates } \varepsilon\}$. Show that $A_{\varepsilon_{\text{CFG}}}$ is decidable.

3) Let $\Psi$ be the set of all infinite sequences over $\{0, 1\}$. Show that $\Psi$ is uncountable using a proof by diagonalization.

4) A useless state in a pushdown automaton is never entered on any input string. Consider the problem of determining whether a pushdown automaton has any useless states. Formulate this problem as a language and show that it is decidable.

5) Let $A = \{<R, S> \mid R \text{ and } S \text{ are regular expressions and } L(R) \subseteq L(S)\}$. Show that $A$ is decidable.

6) Let $R$ be a regular expression and let $G$ be a CFG. Show that the problem of determining whether there exists a string that is generated by both $R$ and $G$ is decidable (note, we are not checking if a specific string $w$ is generated by both $R$ and $G$ but rather if there exists any string that is generated by both $R$ and $G$).

7) Part 2 (of 3). We are continuing the project started in Assignment 3. In this assignment you’ll practice active note taking and close reading.

Starting with the introduction for the paper, set a timer for 30 minutes, and read the paper carefully, until the timer runs out. As you read, actively take notes: underline words or phrases that are important or that you have questions on, mark the text with your own thoughts on the topics, write questions in the margins, look up words, etc. Mark down how far along in the paper you got to in these 30 minutes.

Now spend 10-15 minutes writing down a few (at least 3) questions on the material that you now have after this careful reading.
Write a short reflection (2-3 sentences) on what this process of reading the papers was like for you. Here are some questions to think about as you prepare to write this reflection:

- What are some characteristics of the language and terminology used in the paper?
- What was different about engaging with the paper this time, compared to the process in Assignment 3?
- Do you believe the paper is answering an important question?

These are only suggestions for possible directions for your reflection; you do not have to answer any one of these questions in particular, and you *do not* have to answer all of them. We encourage you to be both reflective and creative.

**Grading**

As a reminder, this project is worth 3% of your final grade. You will be graded on the final reflection you submit as part of Assignment 9.