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 \( A_{\epsilon_{CFG}} = \{ <G> | G \text{ is a CFG that generates } \epsilon \} \). Show that \( A_{\epsilon_{CFG}} \) 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 \( A = \{ <R, S> | R \text{ and } S \text{ are regular expressions and } L(R) \subseteq L(S) \} \). 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, close reading, and generating questions.

Given your preferences in Assignment 3, you have received an email containing the name of the paper you were assigned. Starting with the introduction for that particular 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 seem 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 answering the following questions:

a) Where was the paper you were assigned in your ranking in Assignment 3? Why did you place it there?
b) What connections can you identify between the abstract and the part of the paper you read in these 30 minutes?

c) What was the most challenging part about this second part of the project?

d) In class, you’ll work in groups to help each other engage with the paper more meaningfully. What are two questions you have on the part of the paper you read that you’d like your peers to help you with? Note that these questions don’t have to be on the material itself (for example, your question can be what resources they found to help them understand a certain topic).

Grading

As a reminder, this project is worth 5% of your final grade. This particular part is worth 1%.