

COT 4210 Homework #7: Section 4.1

Assigned: 3/9/2021

Due Date/Time: On Webcourses

- 1) Let $ALL_{DFA} = \{ \langle A \rangle \mid A \text{ is a DFA that recognizes } \Sigma^* \}$. Show that ALL_{DFA} is decidable.

- 2) Let $INFINITE_{DFA} = \{ \langle A \rangle \mid A \text{ is a DFA and } L(A) \text{ contains an infinite number of strings} \}$. Show that $INFINITE_{DFA}$ is decidable.

- 3) Let a 2-PDA be a pushdown automata with access to 2 stacks. (In each transition, we can read the top of both stacks and push something on top of both stacks, if we choose.)
 - a) Give an example of a language that is NOT context free that can be accepted by a 2-PDA. Briefly describe in words how this 2-PDA would operate to accept that language.
 - b) Show that a standard Turing Machine can be implemented using a 2-PDA.

- 4) Let $PERFECT = \{ n \mid n \text{ is a perfect number} \}$. A perfect number is one for which the sum of its proper divisors equals itself. For example, 28 is perfect because $1 + 2 + 4 + 7 + 14 = 28$. Show that PERFECT is decidable. Do some background research and see if you can answer the following question: Is PERFECT a regular language? Why or why not? (Note: PERFECT is decidable, but what is being asked is if it's a regular language or not.)