CSE355 Fall 2016–Recitation Quiz 13 (Solutions)

Name: ______________________ ASU ID: ______________

Monday 9:40AM	Monday 10:45AM	Tuesday 7:30AM	Tuesday 4:35PM	Wednesday 9:40AM
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Wednesday 10:45AM	Thursday 7:30AM	Thursday 4:35PM	Friday 9:40AM	Friday 10:45AM
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1. Show that $SUB_{DFA} = \{\langle M_1, M_2\rangle \mid M_1, M_2 \text{ are DFAs and } L(M_1) \subseteq L(M_2)\}$ is decidable. (Hint: what's another way of writing $L(M_1) \subseteq L(M_2)$?)

   We create a decider D for SUB_{DFA}:

   $D =$ "On input $\langle M_1, M_2\rangle$ where M_1, M_2 are DFAs:

   (a) Construct a DFA M_2' with $L(M_2') = \overline{L(M_2)}$.
   (b) Construct a DFA C with $L(C) = L(M_1) \cap L(M_2')$.
   (c) Run the decider for E_{DFA} on input $\langle C\rangle$.
   (d) If it accepts, accept; otherwise, reject."

   The reasoning is that $L(M_1) \subseteq L(M_2)$ if and only if $L(M_1) \cap \overline{L(M_2)} = \emptyset$.

2. Answer True or False and give a brief explanation as to your answer:

   (a) Decidable languages are not closed under complement.

   False, they are closed under complement. The reasoning is that we can just swap q_{accept} and q_{reject} here, since on every input the decider will always halt in one of these states.

   (b) The problem of checking whether a DFA accepts *some* palindrome (a string that is equal to its reverse) is decidable. (Hint: is the "palindromes" language a CFL?)

   True. Suppose the DFA is D. We can make a CFG G for the set of palindromes over the alphabet Σ. Consider $L(G) \cap L(D)$: this will be non-empty if and only if D accepts some palindrome. Since the intersection of a context-free language and a regular language is context-free, then we can make a CFG G' for $L(G) \cap L(D)$. Then we just run the decider for E_{CFG} on input $\langle G'\rangle$, and output what it outputs.

TA use only! Quiz has been recorded: ☐