University of Nevada, Las Vegas Computer Science 456/656 Fall 2023

Assignment 5: Due Friday October 21, 2023, 11:59 PM

Name:_____

You are permitted to work in groups, get help from others, read books, and use the internet. You will receive a message from the graduage assistant, Sepideh Farivar, telling you how to turn in the assignment.

1. True or False. T = true, F = false, and O = open, meaning that the answer is not known science at this time.

   (a) _____ Suppose L is a binary language. Suppose there is a number k such that, for every $w \in L$ there is an $O(n^k)$ time proof that $w \in L$, where $n = |w|$. Then L is $\mathcal{NP}$.

   (b) _____ SAT is known to be $\mathcal{NP}$–complete.

   (c) _____ 2-SAT is known to be $\mathcal{NP}$–complete.

   (d) _____ 3-SAT is known to be $\mathcal{NP}$–complete.

   (e) _____ 4-SAT is known to be $\mathcal{NP}$–complete.

   (f) _____ The game RUSH HOUR is known to be $\mathcal{NP}$–complete.

   (g) _____ The traveling salesman problem is known to be $\mathcal{NP}$–complete.

   (h) _____ The independent set problem is known to be $\mathcal{NP}$–complete.

   (i) _____ The factorization problem for binary numerals in $\mathcal{P}$–TIME.

   (j) _____ Every regulor language is $\mathcal{NC}$.

   (k) _____ Every context-free language is $\mathcal{NC}$.

   (l) _____ The Boolean circuit problem is $\mathcal{NC}$.

   (m) _____ The subset sum problem is known to be $\mathcal{NP}$–complete.

   (n) _____ The block sorting problem is known to be $\mathcal{NP}$–complete.

   (o) _____ If G_1 and G_2 are contex-free grammars that are not equivalent, there must be a proof that they are not equivalent.

   (p) _____ Recall that a DPDA is a deterministic machine with finite memory plus a stack. A DPDA can emulate any deterministic machine.

   (q) _____ A 2-DPDA is a deterministic machine with finite memory plus two stacks. A 2-DPDA can emulate any deterministic machine.

2. State the pumping lemma for regular languages accurately. If you have all the right words, but the statement does not have the correct logical structure, you might get no credit.

3. (a) State the Church-Turing thesis.

   (b) Why is the Church-Turing thesis important?

4. Give a polynomial time reduction of 3-SAT to the Independent Set problem.

5. Give a polynomial time reduction of the Subset Sum problem to Partition.