

University of Nevada, Las Vegas Computer Science 456/656 Fall 2021

Assignment 5. Due Wednesday October 13, 2021

Name: _____

You are permitted to work in groups, get help from others, read books, and use the internet.

1. Indicate by “Yes” or “No” which of the following languages, or problems, are known to be \mathcal{NP} complete. (You may have to do some research.)

- _____ 2-SAT
- _____ 3-SAT
- _____ 4-SAT
- _____ Partition
- _____ Subset Sum
- _____ Traveling Salesman
- _____ Regular Expression Equivalence
- _____ Vertex Cover
- _____ Rush Hour (the puzzle)
- _____ Linear Programming
- _____ Integer Programming
- _____ Membership Problem for a Context-Free Grammar
- _____ Membership Problem for a Context-Sensitive Grammar
- _____ Block Sorting

2. Let R be the reduction of 3-SAT to the independent set problem as I defined it in class. Let E be the 3-CNF expression given below.

$$(x_1 + x_2 + x_3) \cdot (x_4 + !x_1 + x_5) \cdot (!x_2 + !x_4 + !x_3) \cdot (!x_3 + !x_5 + x_1) \cdot (x_2 + !x_1 + x_4)$$

Let $(G, k) = R(E)$.

- (a) What is k ?
- (b) Sketch G .
- (c) Circle an independent set of k vertices of G .
- (d) Give a satisfying assignment of the variables of E corresponding to that independent set.

3. Prove that a language L is recursively enumerable if and only if there is a machine M which accepts L .
(Recall that you may assume that M is a program.)