

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

Assignment 7: Due Saturday April 29, 2023, 23:59

Name: \_\_\_\_\_

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

1. Determine whether each of these 2CNF expressions is satisfiable. If satisfiable, given a satisfying assignment. Otherwise, prove the expression is a contradiction.

**Additional problems may be added to this assignment later.**

(a)  $(!e+!f) * (!f+!b) * (!d+g) * (e+!j) * (!e+!i) * (!e+!b) * (!f+i) * (!d+g) * (!d+f) * (f+a)$   
 $* (h+i) * (!j+f) * (!d+!h) * (!c+e) * (!c+a) * (!i+!h) * (!b+e) * (a+g) * (!c+!b) * (!f+g)$

(b)  $(!i+f) * (h+!b) * (!h+!d) * (d+b) * (i+!i) * (e+!b) * (i+d) * (g+!d) * (!i+f) * (!f+!c)$   
 $* (!c+!d) * (!b+i) * (h+i) * (!f+!h) * (!d+c) * (a+!h) * (i+d) * (!f+!a) * (!c+!h) * (c+!g)$

2. Give a polynomial time reduction of the subset sum problem to the partition problem.

3. Give a proof that a recursively enumerable language is accepted by some machine.

4. Give a proof that a language accepted by a machine is recursively enumerable.

5. Give a context-sensitive grammar for  $\{a^n b^n a^n : n \geq 1\}$ .

6. Let  $L$  be the language consisting of all strings of  $a$ 's of length a power of 2. That is,  
 $L = \{a, aa, aaaa, aaaaaaaaa, aaaaaaaaaaaaaaaaa, \dots\}$ .

(a) Give a context-sensitive grammar for  $L$ .

(b) Using the grammar you gave for 6a, give derivations of the strings  $a$ ,  $aa$ ,  $aaaa$ , and  $aaaaaaaa$ .

7. Prove that every context-sensitive language is recursive. (You may want to search the internet.)