COMP 314 Homework Assignment 1

1. (5 points) Use proof by contradiction to prove that any string of 30 lowercase letters contains at least one letter twice.

2. (2 points) Fill in the final column of the following table, assuming all programs are as defined in the assigned reading. (The answers are contained in the reading. Feel free to check and correct your answers, but try them on your own first.)

program run	input (file or string)	decision
longerThan1K.py	"abc"	
longerThan1K.py	someLongFile.txt	
longerThan1K.py	containsZ.py	
longerThan1K.py	longerThan1K.py	
containsZ.py	"abc"	
containsZ.py	"abZcde"	
containsZ.py	longerThan1K.py	
containsZ.py	containsZ.py	
containsProdOver100.py	"4 5↵10 20 3"	
containsProdOver100.py	"abc"	
containsProdOver100.py	longerThan1K.py	
containsProdOver100.py	containsProdOver100.py	
lenIsEvenOrOdd.py	"abc"	
lenIsEvenOrOdd.py	someLongFile.txt	
lenIsEvenOrOdd.py	containsZ.py	
lenIsEvenOrOdd.py	lenIsEvenOrOdd.py	
yes.py	"abc"	
yes.py	someLongFile.txt	
yes.py	containsZ.py	
yes.py	yes.py	
infiniteLoop.py	"abc"	
infiniteLoop.py	"secret sauce"	
infiniteLoop.py	containsZ.py	
infiniteLoop.py	infiniteLoop.py	

Note: For the following two questions, your method of proof must be similar to the methods used in class. That is, you must use proof by contradiction. First, assume the existence of the program that solves the problem. Then, give the complete source code of another Python program that invokes the assumed program, and whose behavior is self-contradictory. Then explain in a few sentences why the program produces a contradiction.

3. (10 points) Prove that the following problem is undecidable: given a Python program P and input string I, does P output more than 25 characters on input I? Hint: You need to make a specific assumption about the way the concatenation $P + I$ is done. Feel free to assume that P and I are separated by a fixed, known separator such as "##end-of-program##". See yesOnInput.py for an example of how a program can then split $P + I$ into P and I.

4. (10 points) Prove that the following problem is undecidable: given a Python program P, does P output Yes when given the input "Red Devils"?