COMP 314 Homework Assignment A

Chapter 1

Question A1. (15 points) Give one example of each of the following types of problems: (i) tractable, (ii) intractable, and (iii) uncomputable. Describe each problem in 1–2 sentences. Don't use examples that were already described in Chapter 1—use some brief online research to find different examples.

Question A2. (15 points) In a few sentences of your own words, describe why you are interested in studying the theory of computation. Which, if any, of the reasons given in Section 1.7 do you feel motivated by?

Chapter 2

Question A3. (Ungraded) Spend a few hours working through the basics of Python using an online tutorial. I like the *Python Programming* wikibook, available at `http://en.wikibooks.org/wiki/Python_Programming`. Or, choose one of the other tutorials from the list at `https://wiki.python.org/moin/BeginnersGuide/Programmers`. At an absolute minimum, make sure you understand the basics of `if` statements, `for` and `while` loops, and the three main data structures in Python: lists, sequences, and dictionaries.

Question A4. (Ungraded) Work through all the practical exercises suggested in Sections 2.1–2.3. In particular, this includes:

- Change the outputs of `containsGAGA.py` to be `yep` and `nope`. Test it, then return `containsGAGA.py` to its original form.

- Run `containsGAGA.py` using the contents of `geneticString.txt` as input.

- Create a new Python program, `temp.py`, that executes `containsGAGA` on several different inputs, including the contents of `geneticString.txt`, and prints the results of each.

- Run `countLines.py` and `longestWord.py` on the contents of `wasteland.txt`.

- Run each of the five programs in Figure 2.5, and verify that the expected error or misbehavior is observed.

Question A5. (20 points) Write a SISO Python program that takes as input a list of integers separated by whitespace. The output is a string representing the sum of every second integer in the list. For example, if the input is "`58 41 78 3 25 9`" then the output is "`53`", because $41 + 3 + 9 = 53$.

Question A6. (5 points) Write another SISO Python program, which is similar to the previous question, but adds up every *third* element of the input instead of every second element.

Question A7. (10 points) Write a SISO Python decision program which accepts a list of integers if the sum of every third element is greater than the sum of every second element, and rejects otherwise. Your program need only work correctly on inputs that are lists of integers. Your program must import and use the programs from the previous two questions.

Question A8. (10 points) Write a SISO Python program which takes two parameters, and returns a string representing the number of times the character `G` occurs in each parameter, separated by a newline character. For example, if the two input parameters are ("`CAGGT`", "`GTGTGTGT`"), the output should be "`2↵4`".

Question A9. (12 points) Which of the following strings P is a Python program, according to using the formal definition given in the Section 2.5? (You may base your definition on any reasonable reference computer C.)

(a) $P=$"`def f(x):   return x`"

(b) $P=$"`def f(x):   x = 'am I a Python program?'`"

(c) $P=$"`x = str(7+2*5)`"

(d) $P=$"`def f(x,y,z):   return y`"

(e) $P=$"`def f(x):   return y`"

(f) $P=$"`def f(x):   ret x`"

Question A10. (18 points) For each of the following Python programs P and input strings I, give the output $P(I)$, using the formal definition of $P(I)$ given in the Section 2.5, and employing any reasonable reference computer C.

(a) $P=$"`def f(x):   return x[-2]`"
    $I=$"`abcdefgh`"

(b) $P=$"`def f(x):   return x+5`"
    $I=$"`43`"

(c) $P=$"`def f(x):↵while True:↵   pass↵return x`"
$I=$"CAGGT"

(d) $P=$"`def f(x):  return x[3:7]`"
$I=$"abcdefghij"

(e) $P=$"`def f(x):  return x[3:7]`"
$I=$"ab"

(f) $P=$"`def f(x):  return str(len(x+x+'x'))`"
$I=$"GAGAT"

(g) $P=$"`def f(x):  return str(len(x))`"
$I = P$

(h) $P=$"`def f(x):  return str(1/int(x))`"
$I=$"0"

(i) $P=$"`def f(x,y):  return x[-1]+y[-1]`"
$I_1=$"abc", $I_2=$"xyz". (Give $P(I_1, I_2)$ for this part.)

Question A11. (6 points) Which pairs of the following Python programs are equivalent?

- $P = $ "`def f(x):  return str(len(x)+1)`"

- $Q = $ "`def f(x):  return str(len(x+'a'))`"

- $R = $

```
def f(x):
    L=1
    while L!=len(x): L=L+1
    return str(L+1)
```

Total points on this assignment: 111