CSCI 162 Assignment 4

Due April 14, 2014

[40] Answer these questions in a .doc or .txt file and submit via Moodle. The name of the file must be in the format JB123456789.txt (or .doc) where JB is your initials and 123456789 is your student number.

1. [10] Context free grammars. (CFG)

1a. [2] What does it mean if a context free grammar is ambiguous. Give an example.

1b. [5] Create a CFG for complex numbers (like 4i+32, or 150i+1288). (<digit> is given for you.

<digit> :: = 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

1c. [3] Using your CFG, show the parse tree for 13i+4567

2. [10] Draw a Finite State Machine that accepts strings in the following format: a*b*(ba + ab)*

3. [10] Given a Turing Machine that recognizes the following commands:

Commands
- if   (Eg. if read 1, write 0)
- while   (Eg. while read 1, write 0)
- whileNot   (Eg. whileNot read $, goLeft)
- read X   (X can be 1, 0, # or $. Use with the first 3 commands.)
- write X   (X can be 1 or 0)
- goLeft   (Go Left one space)
- goRight   (Go Right one space)
- HALT   (Stop execution. The number is now the absolute value of the original value.)

Create a program to compute the absolute value of a twos complement number. The number is stored with a $ on the far left and a # on the far right to indicate the end of the number. It can be any number of digits long, but the first digit on the left indicates the sign. Below is a sample number:

$	1	0	1	1	0	1	0	0	#

The Turing Machine is positioned so that the next thing it reads will be the $ on the left. Hint: if the number is already positive you do not have to change anything.

4. [10] The following table of the distances between the cities (A,B,C,D,E,F,G) use whatever means you choose to find the shortest path so someone starting at A can visit each of the other cities and return to A.

	G	F	E	D	C	B	A
A	5000	50	90	70	100	20	
B	5000	30	80	50	300		
C	5000	200	600	400			
D	10	40	50				
E	5000	20					
F	5000						
G							

Note 1: The numbers in this table represent distances in km, so it is 600 km from C to E. Since the intersection of row C and column E has the number 600. Since the table is unordered, it is also 600 km from E to C.

Note 2: The best route might involve visiting the same city more than once, but each city must be visited at least once.

Note 3: There may be more than one "best" solution.

4a. [5] What is the route you found?
4b. [1] How many km does this route take?
4c. [3] How do you know there is no shorter route?
4d.[1] In the equation P=NP , what does P represent? What does NP represent?