**CS 3160 Concepts of Programming Languages**

**Fall 2018 Assignment 1**

**Due 9-5-2018**

1. What is the biggest difference between a compiled language and an interpreted language?
2. Which of the following defines or correctly categorizes the halting problem?
3. Whether an arbitrary problem can halt eventually when given an arbitrary input
4. The halting problem is not solvable (i.e., not computable by computers)
5. Whether an arbitrary program can always halt for all program inputs.
6. Whether some given program can always halt for arbitrary program inputs.
7. Identify whether the following function definition is a partial function or total function on the integers. If the function is partial, say where the function is defined and undefined.

A. f(x) = if (x + 2) > 5 then x + 2 else x/0

B. f(x) = if x < 0 then 1 else f(x - 2)

1. Write a function named **duplicate-first-element** in LISPthat takes in a list and duplicates the first element of the list as shown below

> (duplicate-first-element ’ (1 2 3) ) (1 1 2 3)

1. Deﬁne a function **product** which takes an arbitrary parameter x, and returns the product of all numeric values (i.e., numbers) contained within x. Test your code with the following expressions.

> (product ’x) 1

> (product ’(x 5)) 5

> (product ’((2 2) 3) ) 12

> (product ’((a 3) (2 1)) ) 6

1. Write a recursive function **list-len** that takes a list input and returns the length of the list. Test your code with the following expressions.

> (list-len ’( 1 2 3)) 3

> (list-len ’ (( 1 2 3)( 4 5))) 2

> (list-len ’ (( 1 2 3)( 4 5) ( a (b) c))) 3

1. Write a function in LISP to get the last atom in the list. You can use built-in functions like length to write this function. For example

> (last-atom ‘(a b c d e f)) f