

Assignment 4

CSI2120 Programming Paradigms

Winter 2015

Due on March 30th, 2015 before 11:00 pm in Virtual Campus

[5 marks in total]

Question 1. [2 points]

Write a Scheme function to sort the elements of a list of coordinates (X, Y, Z). The coordinates should be sorted first by X then by Y and then Z.

For example:

```
(threeD '((2 1 1) (1 3 5) (1 3 7) (1 2 3)))
```

```
⇒ '((1 2 3) (1 3 5) (1 3 7) (2 1 1))
```

Question 2. [2 points]

In a modification of the binary search tree data structure from class, the element at each node is a dotted pair in which the first term is the value associated with each node and the second is the number of times a node with that value has been inserted in the tree. A non-empty binary search tree is represented by a list of 3 items. The data structure is illustrated by the following example:

The binary search tree

```
      14.1
     /  \
    /    \
   7.2   26.1
  /  \  /  \
12.1 20.3 31.1
   /  /  \
17.1 30.1 35.1
```

Has the following list representation:

```
(define t2
'((14 . 1)
 ((7 . 2) () ((12 . 1) () ()))
 ((26 . 1)
  ((20 . 3) ((17 . 1) () ()))
  ((31 . 1) ((30 . 1) () ()))
  ((35 . 1) () ())))
```

In the above tree, the value 7 has been inserted 2 times and the value 20 has been inserted 3 times. The other nodes have been inserted once.

Write the function `(insertT value tree)` to insert a value in such a tree. For example:

```
(insertT 26 t2)
```

```
⇒ ((14 . 1) ((7 . 2) () ((12 . 1) () ())) ((26 . 2) ((20 . 3) ((17
  . 1) () ()) ()) ((31 . 1) ((30 . 1) () ()) ((35 . 1) () ())))))
```

Question 3. [1 point]

Design a Scheme function that calculates the magnitude of a vector, defined as the sum of the absolute value of all its elements. For example:

```
(q3 '#(3 -4 5.6 -7.1))
⇒ 19.7
```