UNIVERSITY of GUELPH

**CIS2520 Data Structures**
Fall 2011, Assignment 4

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Download **assign3key.zip** from **Moodle**.
It packs a folder **BSTree**.

## QUESTION 1 (25%): *Binary Search Trees*

Modify the files in the folder **BSTree** as indicated below.

**1)** Expand the Binary Search Tree library. Implement the following functions:

```
// returns the number of nodes of the tree
extern int Size (Tree *T);

// returns the height of the tree
extern int Height (Tree *T);

// returns 1 if the tree is balanced, 0 otherwise
extern int Balanced (Tree *T);
```

**2)** Modify **myProgram.c** to test the functions above.
The output of the program should now be:

```
Initialize()
Size=0, Height=-1, Balanced=YES

Insert(John,75)
Size=1, Height=0, Balanced=YES

Insert(Mary,85)
Size=2, Height=1, Balanced=YES
```

```
Insert(Pete,80)
Size=3, Height=2, Balanced=NO

Insert(Liz,55)
Size=4, Height=2, Balanced=YES

Insert(Tom,45)
Size=5, Height=2, Balanced=YES

Insert(Bob,60)
Size=6, Height=2, Balanced=YES

Insert(Ann,70)
Size=7, Height=3, Balanced=YES

Insert(Ashley,35)
Size=8, Height=3, Balanced=YES

Insert(Karen,65)
Size=9, Height=4, Balanced=NO

Insert(Dave,90)
Size=10, Height=4, Balanced=NO

Insert(Adam,45)
Size=11, Height=4, Balanced=NO
```

## QUESTION 2 (35%): *AVL trees*

Create a copy **AVLtree** of the revised folder **BSTree**. In **TreeImplementation.c** of this new folder **AVLtree**, modify `Insert()` so that the tree is always balanced.

## QUESTION 3 (40%): *Heaps*

Write a program that accepts a positive integer **n** as argument, reads the student data name+grade stored in the text file **test.txt** (see example below), and outputs the top **n** students according to their grades.

For example:
`./a.out 1` should output `Paula 92`.
`./a.out 3` should output `Paula 92`, `Dave 90` and `Mary 85` (in no particular order).

Your program should rely on a minimal Heap library, which you are asked to write using a sequential representation. Pack all your files (***.c**, ***.h**, **test.txt**, **makefile**) in a folder **Heap**.

**test.txt**

```
Adam 45
Ann 70
Anthony 82
Ashley 35
Bob 60
Brian 77
Daniel 68
Dave 90
John 75
Karen 65
Kirsty 41
Liz 55
Mary 85
Michelle 73
Monica 66
Paula 92
Pete 80
Roger 54
Tom 45
Val 59
```

## SUBMISSION

Make sure the folders **BSTree**, **AVLtree** and **Heap** contain text files only, and make sure all the files in **BSTree** and **AVLtree** (including the file and function header comments) have been updated according to the requested changes.

Place the three folders in a root folder **CIS2520_LastNameFirstName_A4**.
Zip the root folder and upload it to **Moodle** by Nov 27, 11:55pm.