Introduction to Computer Science
HW #6
Due: 2015/06/17

Homework Rules:

Hand-written homework can be handed in in class. Otherwise, you may contact the TA in advance and then bring the hardcopy to the TA in BL421.

As for the programming part, you need to upload it to CEIBA before the deadline. The file you upload must be a **.zip** file that contains the following files:

README.txt

HW01_b03901XXX (a folder that contains all .cpp & .h as required),

1. Do not submit executable files (.exe) or objective files (.o, .obj). Files with names in wrong format will not be graded. You must **remove any system calls**, such as system ("pause"), in your code if you use it.
2. In README.txt, you need to describe which compiler you used in this homework and how to compile it (if it is in a "project" form).
3. In your .cpp files, we suggest you write comments as detailed as you can. If your code does not work properly, code with comments earns you more partial credits.

Chapter 12 Review Problems (10% each)

15. Design a Turing machine that reverses the pattern of 0s and 1s that it finds between the current cell (which contains an asterisk) and the first asterisk to the left.

17. Is the following Bare Bones program self-terminating? Explain your answer.

```
copy X to Y;
incr Y;
incr Y;
while X not 0 do;
  decr X;
  decr X;
  decr Y;
  decr Y;
end;
decr Y;
while Y not 0 do;
  incr X;
  decr Y;
end;
while X not 0 do;
end;
```

27. Design an algorithm for deciding whether a given positive integer is prime. Is your solution efficient? Is your solution a polynomial or nonpolynomial one?

30. Charlie Programmer is given the problem of dividing a group (of an even number of people) into two disjoint subgroups of equal size so that the difference between the total ages of each subgroup is as large as possible. He proposes the solution of forming all possible subgroup pairs, computing the difference between the age totals of each pair, and selecting the pair with the largest difference. Mary Programmer, on the other hand, proposes that the original group first be sorted by age and then divided into two subgroups by forming one subgroup from the younger half of the sorted group and the other from the older half. What is the complexity of each of these solutions? Is the problem itself of polynomial, NP, or nonpolynomial complexity?

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M1. (3%) Draw the BST (10 nodes) whose post-order traversal is 0,1,3,2,5,7,6,9,8,4.
M2. (2%) Draw the BST after 7.5 is inserted in the above tree in M1.
M3. (2%) Draw the BST after 1 is deleted from the above tree in M2.
M4. (3%) By replacing with its successor, draw the BST after 4 is deleted from the above tree in M3.

Programming Problem (50%):

Write a class **MinHeap** which is derived from **AbsHeap** (in "absheap.h"). Implement the two virtual functions in AbsHeap. This is a binary min heap, so pop() always returns the element with the minimum key. You may assume **all keys are distinct**. You need to save your code in "heap.h".

For your test convenience, you may use testHeap.cpp to test your heap. You should add a line: "typedef MinHeap Heap;" in heap.h to make testHeap.cpp work properly.

Bonus (5%): Deletion in BST:

Download the "bst.h" on ceiba. Then write a function:

```
void erase(int val)
```

to delete the key value "val" from the BST. Your code need to properly handle memory (you need to release the node that is to be deleted). Also, the running time of your code should be proportional to the height of the BST.

How to submit:

Compress all your files into one single file and then submit electronically via Ceiba by the due date.