Instructor: Dr. Sartaj Sahni
Fall, 2002

Advanced Data Structures
(COP 5536 /NTU AD 711R)
Exam 1

CLOSED BOOK
60 Minutes
Take one Week after Lecture 13 (Oct. 4th 2002)

Name: _____

SSN: _____

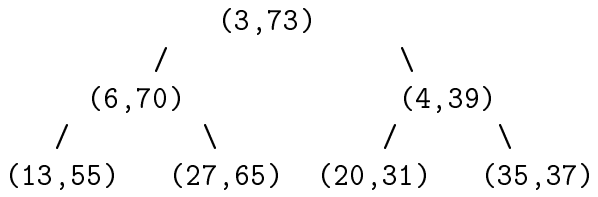
NOTE:
1. **For all problems, use only the algorithms discussed in class/text.**
2. All answers will be graded on correctness, efficiency, clarity, elegance and other normal criteria that determine quality.
3. The points assigned to each question are provided in parentheses.

1. (10) Suppose that a sequence of n operations is performed on a data structure. The kth operation has a cost of $2\sqrt{k}$ whenever k is a perfect square (k = 1, 4, 9, 16, 25, etc), and otherwise it has a cost of 1. Use any one of the following methods of analysis to determine the amortized cost per operation: aggregate, accounting, or potential method. Please specify which method you are using. (find the *smallest* integer amortized cost)

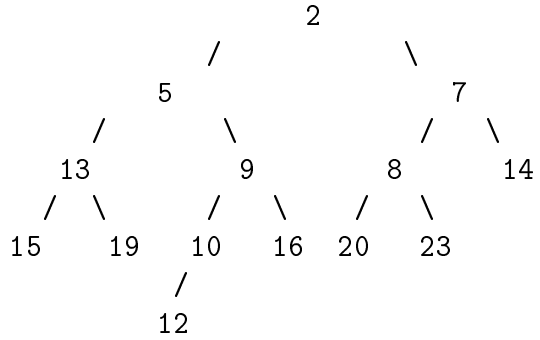
2. (10) Describe $Huffman's$ greedy algorithm to construct a binary tree that has minimum weighted external path length.

3. (10) Given the *interval heap* shown below, show the final interval heap produced by the following sequence of operations: $insert(71)$, $RemoveMin()$.

   (Use the algorithms discussed in class and showing steps)



4. (10) For the following *height − biased min leftist tree*,
   Perform a *RemoveMin* operation, showing each step.



5. (10) Start with an empty *min binomial heap*,

   (a) (4) *Insert* the following sequence of keys into the *min binomial heap*:

   15, 35, 3, 18, 17, 25, 30, 21, 1, 4, 2

   Show the resulting structure.

   (b) (6) Perform a *RemoveMin* operation on the tree of (a) (showing each step)
   (Note: For consistency in solution, if you have three binomial trees of the same size in the intermediate steps, please leave the binomial tree with the largest root, and combine the other binomial trees.)