Indian Statistical Institute, Bangalore

CS3, Mid Semester Examination, September 2013   Max Marks:28; Weightage 14%

Max Time: 2 hrs   Instructor : R. Badrinath

1) Consider fully parenthesized integer expressions:
   Examples: ((45+34)+(98+5)) and (2+(3-4)) *but not* (45+34)+(98+5) or (2+3-4) or 2+3
   Assume you have available a function getToken() that returns the next item. For example x=getNext(),
   so you can test x==")" or Isnum(x). x==END will indicate end of input.

   a) Your task:
       (i) Assuming there is only one operator "+", Write an algorithm
       Evaluate() which Evaluates the given fully parenthesised expression and returns the value.
       Assume incorrect expressions are not given.
       (ii) What is the complexity of your algorithm?   **(8 marks)**

   b) Serially number the lines in your above algorithm.
       If you were now to evaluate expressions with two operators "+" and
       "-", indicate where you would insert lines to make it work and write
       those lines.   **(4 marks)**

2)
   a) You wish to merge two BSTs. It happens that all the elements in
       the first are smaller than the smallest in the second. Outline a
       strategy to merge them that takes no more time than the maximum of the
       heights of the trees.

                                                                         (3 marks)
   b)   You wish to merge two min-heaps(on arrays). It happens that all the
       elements in the first heap are smaller than the smallest in the
       second. Outline an efficient strategy to merge them. Mention the
       complexity of your strategy.   **(3 marks)**

3)
   a) A student was asked to write a recursive merge sort algorithm. He
       decided to on a clever strategy - he would use radix sort when the
       array became smaller than 100 elements in the recursive
       process. Analyze the complexity of the algorithm (Theta). In what sense is it a
       good or bad idea?

                                                                         (4 marks)
   b) A second student answering the same question above, decided to
       use insertion sort when the array became very small - 4 elements or
       less. In what sense is this idea a good one or bad one?

                                                                         (3 marks)
   c) On what basis would you choose between the data structures BST
       and 234 Tree to implement a data structure to support searching and
       why?   **(3 marks)**