

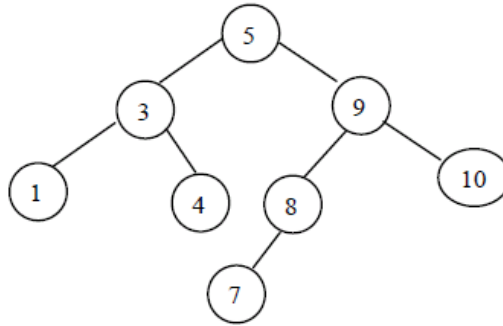
# Data Structures and Programming

Spring 2017, Homework # 3

Due: May 23, 2017

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1. (30 pts) The following questions concern splay trees. For the insertion and deletion operations, use the methods discussed in class.
  - (1) (10 pts) Is it true that the worst case time performance of insert operation is  $O(\log n)$ ? Briefly explain your answer.
  - (2) (10 pts) Draw the tree after deleting item 8 from the following splay tree. Show your steps in detail.
  - (3) (10 pts) Draw the tree after inserting item 8 back to the splay tree generated in (2). Show your steps in detail.



2. (15 pts) Suppose we wish to insert the keys *A L G O R I T H M F U N* into an initially empty 2-3-4 tree. The keys are presented for insertion in the order given and are stored in alphabetical order within the Dictionary. Show your steps in sufficient detail.
3. (25 pts) Show that the amortized time of a zig-zag splay is at most  $3(R_f(X) - R_i(X))$ , where  $R_f(X)$  and  $R_i(X)$  are the ranks of the root  $X$  after and before the step, respectively.