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February 11, 2008 **Data Structure I**

SOLVE EXACTLY THREE OUT OF THE FOLLOWING FIVE PROBLEMS:

1. a. What is the maximum number of regiones defined by n straight lines in the plane?

   b. What is the maximum number of finite regiones defined by n straight lines in the plane?

2. Let $x^{\overline{m}} = x(x+1)\cdots(x+m-1)$

   $$\nabla f(x) = f(x) - f(x-1)$$

   what is $\nabla(x^{\overline{m}})$?

3. Which of the following statement is true?

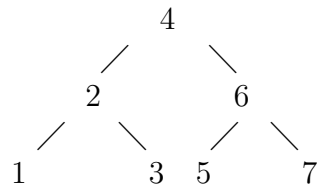
   a. If $f(N) = O(g(N))$ then $g(N) = o(f(N))$

   b. For k large enough, $N = O(log^k N)$

   c. $NlogN = O(N^{1+\frac{1}{logN}})$

   d. If $f(N) = O(T(N)), g(N) = O(T(N))$ and $f(N) - g(N) = o(T(N))$ then $f(N) = O(g(N))$ and $g(N) = O(f(N))$.

4. Show the result of inserting $16, 15, 14, 13, 12, 11$ to the AVL tree



For each insertion, give the resulting tree, indicate you need to do single rotation, double rotation or no rotation.

5. Suppose we have 11 memories with address 0 through 10, if we use the hash function $h(x) = x \ (mod\ 11)$ and the separate chaining algorithm for storing data, give an example of a data of size 6 that result a chain of length 6.