CS 430 – FALL 2017
INTRODUCTION TO ALGORITHMS
HOMEWORK #5
DUE Fri Oct 27, 11:25am

1. (4 points) Exercise 15.3-4

2. (4 points) Write pseudocode to output the nodes in order for the optimal binary search tree given the r(i,j) array (the array that holds the root choices during the construction of the A array). The ordering should be top to bottom, left to right as shown below. Explain that this can be done in O(n) time.
Example BST with nodes numbered:

dog,1
cat,2 frog,3
bird,4 cow,5 (empty),6 goat,7
(empty),8 (empty),9 cheetah,10 dingo,11 (empty),12 (empty),13 gecko,14 hamster,15

The output should look like
1,dog
2,cat
3,frog
4,bird
5,cow
6,(empty)
7,goat
8,(empty)
9,(empty)
10,cheetah
11,dingo
12,(empty)
13,(empty)
14,gecko
15,hamster

(Hint: Recursively walk through the r(i,j) array starting from r(1,n) and store the key values (or empty) in a global array.)

3. (4 points) Exercise 16.1-2

4. (4 points) Exercise 16.2-3

5. (4 points) In the art gallery guarding problem we are given a line L that represents a long hallway in an art gallery. We are also given a set $X = \{X_O, X_1, \ldots, X_{n-1}\}$ of real numbers that specify the positions of paintings in this hallway. Suppose that a single guard can protect all the paintings within distance at most 1 of his or her position (on both sides). Design an algorithm for finding a placement of guards that uses the minimum number of guards to guard all the paintings with positions in X. A guard can be placed at any position in the hallway. Prove the required properties of the problem and for your solution approach.

6. (5 points) A subsequence is a palindrome if it is the same when read left to right and right to left. A subsequence does not have to be contiguous. Describe a polynomial-time algorithm to find the longest subsequence which is a palindrome in a given string represented by an array A[1..n]. For example, the string abcab has four palindromes of length 3: aba, aca, bcb, and bab, but no palindrome of length 4. Prove the required properties of the problem and for your solution approach.