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CS 2050

HW #3

Remaining Part

EX 3.2

#1 EASY QUESTION

The #9 Comparison made to Build BST is 26
ie $(1+1+2+2+3+1+4+3+4+5) = 26$

#9

$N=210$

$N=315$

$N=414$

The tree become more complicated as N goes higher

3.2.15

floor("A") = ADEJM

ceil("B") = ST

Select(5) = M (5th Smallest)

rank(J) = POSITION in Order = 4

size(D,T) = size(D) + size(T)
 $= 1 + 1 + 1 + 1 + 1 = 5$

key(D,T) = A, D, S, T

④ The maximum nodes in a BT^q of depth N is $2^N - 1, N \geq 1$

⑤ The minimum nodes in a BT^q of depth N is One, b/c

$$2^N - 1, N \geq 1$$

$$2^1 - 1 = 2 - 1 = 1$$

i.e at least there will be root w/out any leaf/children

The following note is something, which I used for Citation for the above diagrams.
(GOOGLE)

The number of binary search trees can be seen as a recursive solution. i.e., Number of binary search trees = (Number of **Left** binary search sub-trees) * (Number of **Right** binary search sub-trees) * (Ways to choose the root)

In a BST, only the relative ordering between the elements matter. So, without any loss on generality, we can assume the distinct elements in the tree are $1, 2, 3, 4, \dots, n$. Also, let the number of BST be represented by $f(n)$ for n elements.

Now we have the multiple cases for choosing the root.

1. choose 1 as root, *no* element can be inserted on the left sub-tree. $n-1$ elements will be inserted on the right sub-tree.
2. Choose 2 as root, 1 element can be inserted on the left sub-tree. $n-2$ elements can be inserted on the right sub-tree.
3. Choose 3 as root, 2 element can be inserted on the left sub-tree. $n-3$ elements can be inserted on the right sub-tree.