Drew Smith

CS124

Project 3

10/21/20

When searching for 0, 101, and 102 in the BST of integers you will get a depth of 0 for 0 and depth of 100 for 101 and 102, since zero would be at the top of tree it not being there simply means its not in the tree and for 101 and 102 the method would search all the depths until it does not find it in this case that is 100.

For the differences between the ordered binary search tree and the random order binary search tree. Simply the binary search tree the ordered one will be in perfect order down to the right because the values are in ascending order. While the depths of the random order one will be determined by where the number is placed in the random order vector.

For my tennis winners BST, you can see as the depths go further down the almost stair step as each node gets its two children. This is different from the ordered integer because this one simply just goes down continuously with each number added. While the random number binary search tree the depths and locations are determined by the location in the randomly generated order.

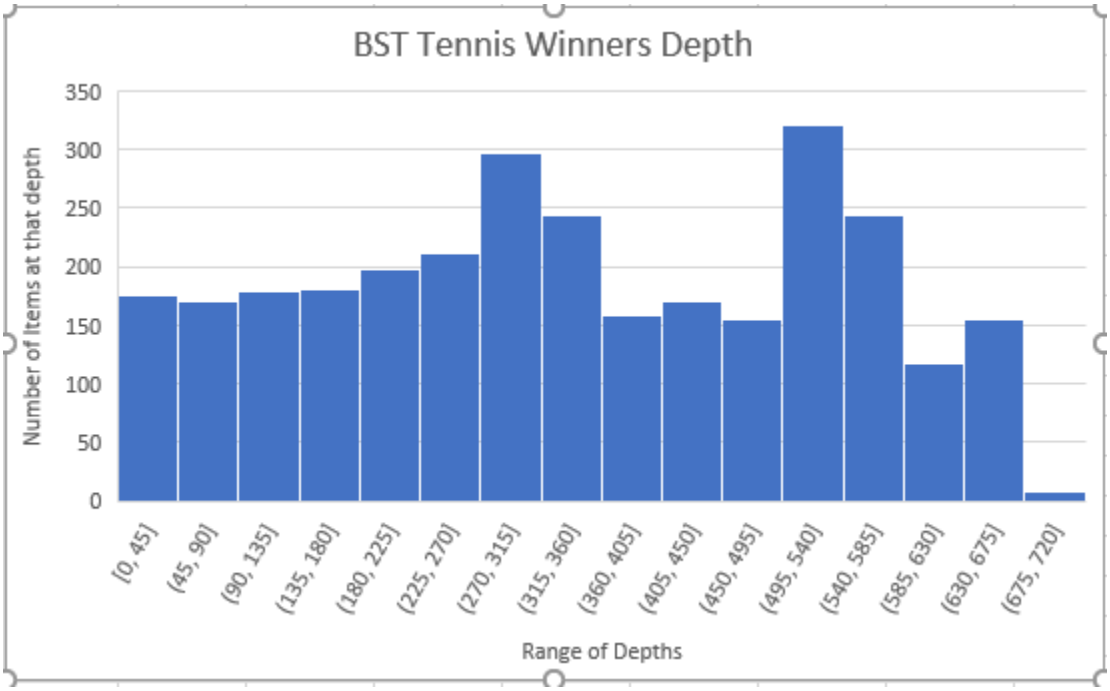
Comparing AVL to BST the depth the two go are very different. AVL simply does not need nearly as many layers as BST needs. AVL's lowest depth is only 6 while BST will go as deep as 100 in the ordered.

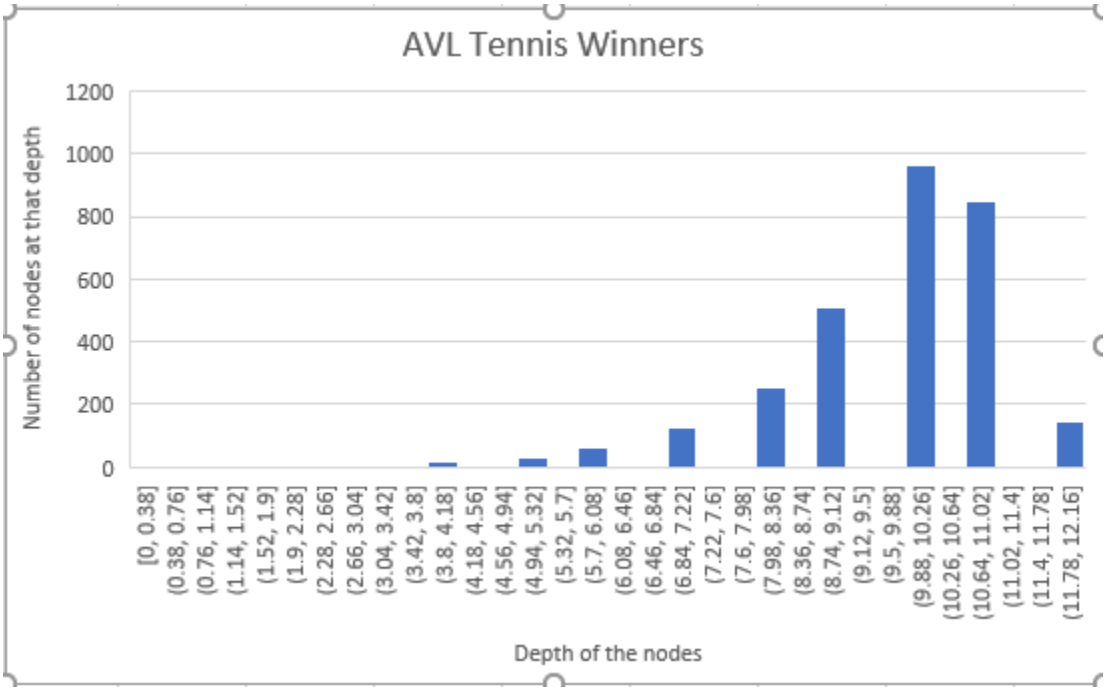
The same thing is true when you move into our data sets. While BST is going down super far AVL does not need to do this because of it checking and moving nodes when they do not satisfy the AVL requirements anymore.

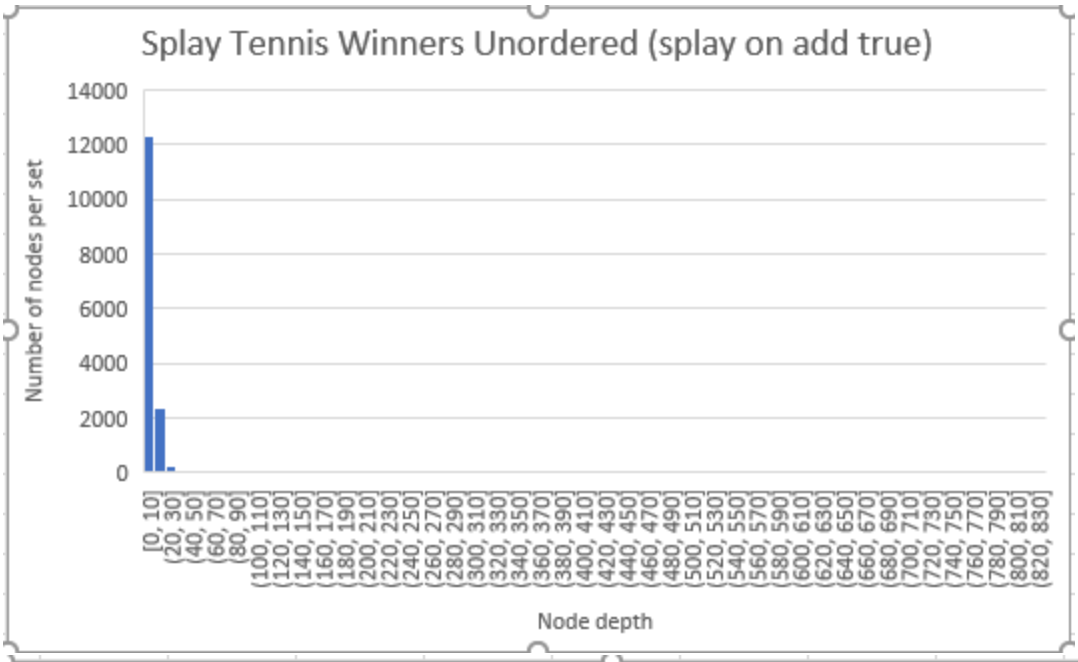
Splay ordered moves the nodes down as it adds new ones so the depth after the first value will always be 1. For the unordered the depths are much less uniform how ever tend to follow a pattern. This is due to when the node is found it is brought up to the root and the values that are after are right below it.

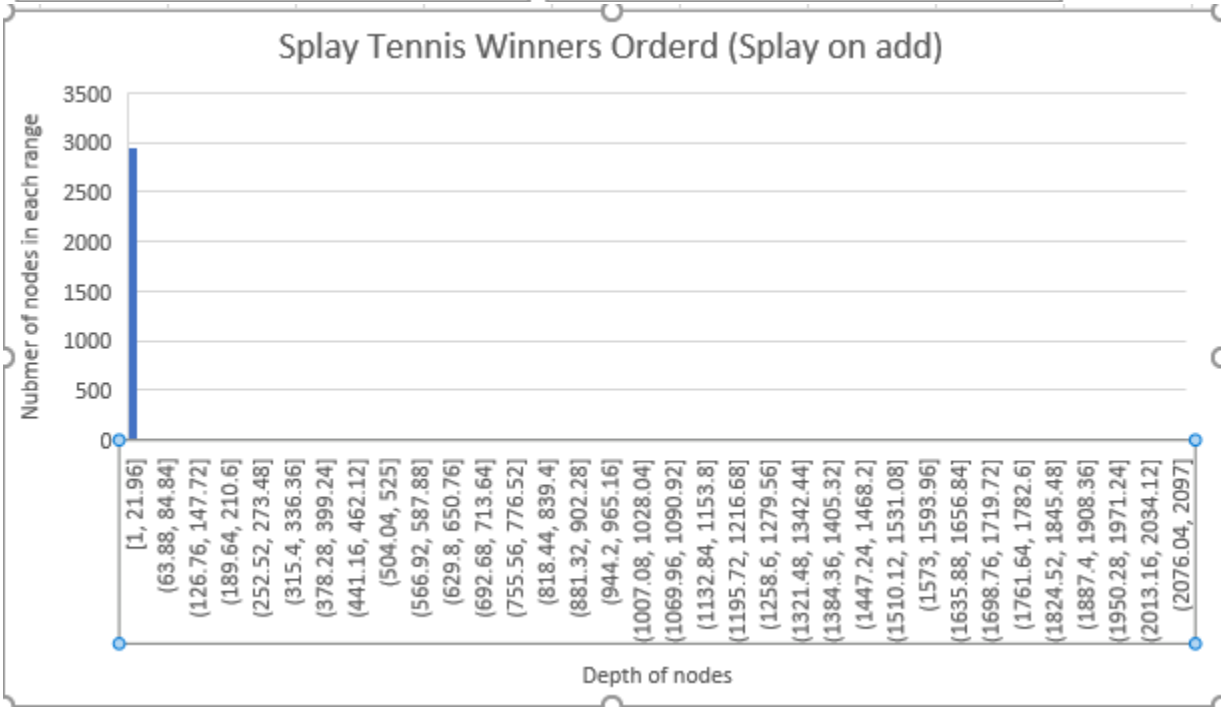
For the splay tree of my tennis winner's data set. This was done by finding each node 5 times in a row. This led to the output of depths being a depth it was originally at then the following 4 being zero. This is because as the node was found it moved to the root and this would repeat for all the values in the data set.

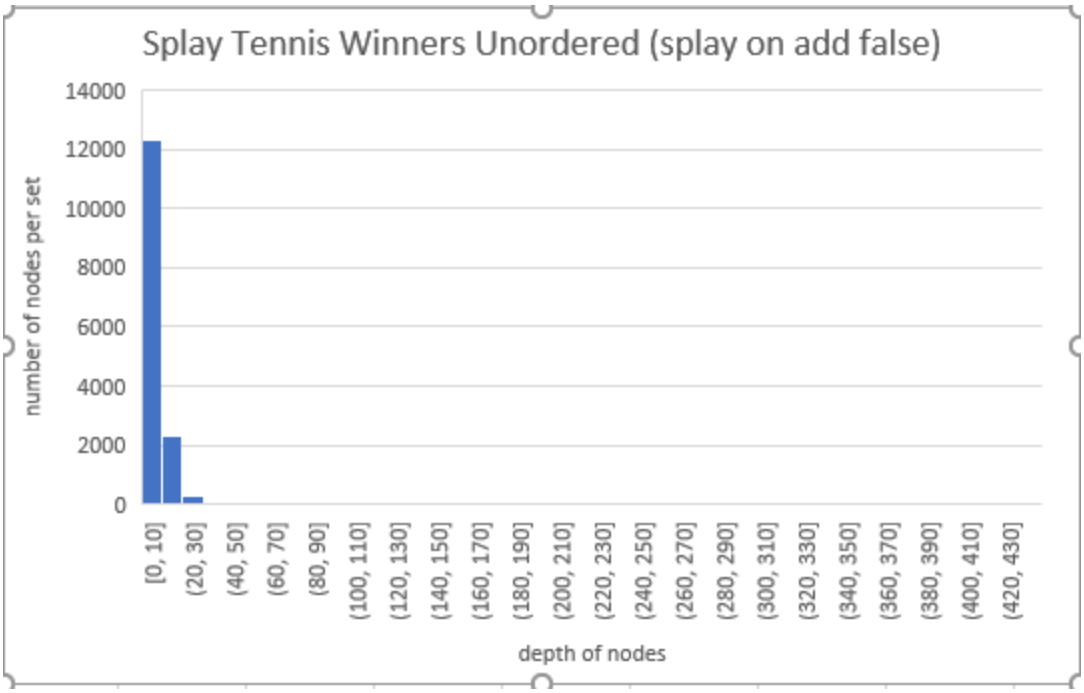
Graphs:

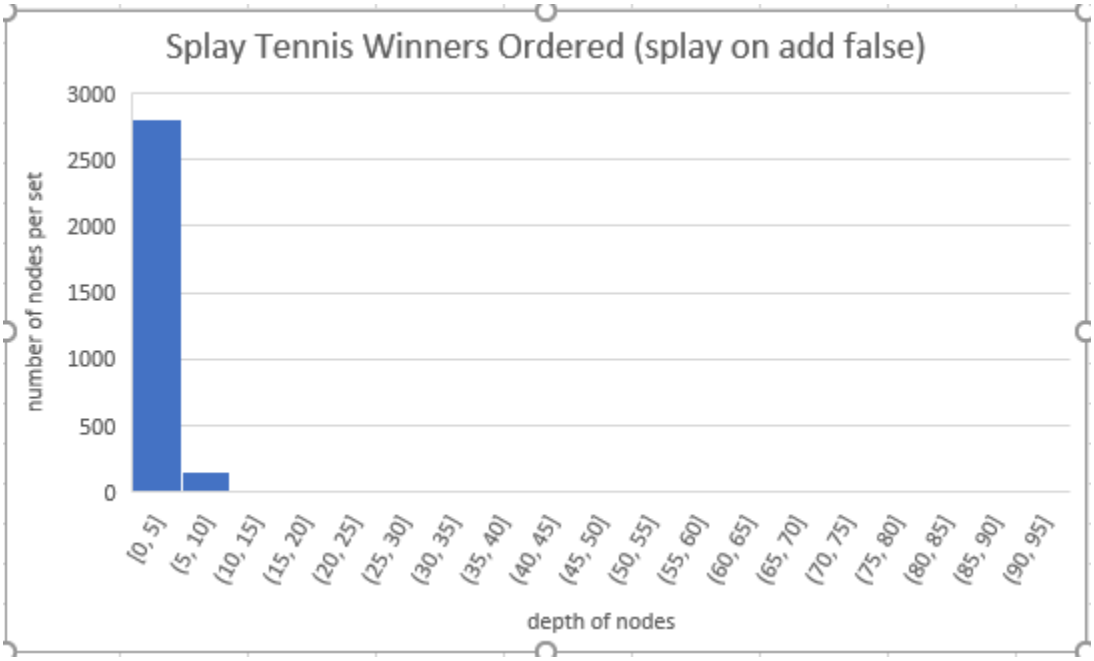

BST Tennis Winners Depth
Number of Items at that depth
350
300
250
200
150
100
50
0
[0, 45]
(45, 90]
(90, 135]
(135, 180]
(180, 225]
(225, 270]
(270, 315]
(315, 360]
(360, 405]
(405, 450]
(450, 495]
(495, 540]
(540, 585]
(585, 630]
(630, 675]
(675, 720]
Range of Depths


AVL Tennis Winners
Number of nodes at that depth
1200
1000
800
600
400
200
0
[0, 0.38]
(0.38, 0.76]
(0.76, 1.14]
(1.14, 1.52]
(1.52, 1.9]
(1.9, 2.28]
(2.28, 2.66]
(2.66, 3.04]
(3.04, 3.42]
(3.42, 3.8]
(3.8, 4.18]
(4.18, 4.56]
(4.56, 4.94]
(4.94, 5.32]
(5.32, 5.7]
(5.7, 6.08]
(6.08, 6.46]
(6.46, 6.84]
(6.84, 7.22]
(7.22, 7.6]
(7.6, 7.98]
(7.98, 8.36]
(8.36, 8.74]
(8.74, 9.12]
(9.12, 9.5]
(9.5, 9.88]
(9.88, 10.26]
(10.26, 10.64]
(10.64, 11.02]
(11.02, 11.4]
(11.4, 11.78]
(11.78, 12.16]
Depth of the nodes


Splay Tennis Winners Unordered (splay on add true)
Number of nodes per set
14000
12000
10000
8000
6000
4000
2000
0
[0, 10]
(20, 30]
(40, 50]
(60, 70]
(80, 90]
(100, 110]
(120, 130]
(140, 150]
(160, 170]
(180, 190]
(200, 210]
(220, 230]
(240, 250]
(260, 270]
(280, 290]
(300, 310]
(320, 330]
(340, 350]
(360, 370]
(380, 390]
(400, 410]
(420, 430]
(440, 450]
(460, 470]
(480, 490]
(500, 510]
(520, 530]
(540, 550]
(560, 570]
(580, 590]
(600, 610]
(620, 630]
(640, 650]
(660, 670]
(680, 690]
(700, 710]
(720, 730]
(740, 750]
(760, 770]
(780, 790]
(800, 810]
(820, 830]
Node depth


Splay Tennis Winners Orderd (Splay on add)
Nubmer of nodes in each range
3500
3000
2500
2000
1500
1000
500
0
[1, 21.96]
(63.88, 84.84]
(126.76, 147.72]
(189.64, 210.6]
(252.52, 273.48]
(315.4, 336.36]
(378.28, 399.24]
(441.16, 462.12]
(504.04, 525]
(566.92, 587.88]
(629.8, 650.76]
(692.68, 713.64]
(755.56, 776.52]
(818.44, 839.4]
(881.32, 902.28]
(944.2, 965.16]
(1007.08, 1028.04]
(1069.96, 1090.92]
(1132.84, 1153.8]
(1195.72, 1216.68]
(1258.6, 1279.56]
(1321.48, 1342.44]
(1384.36, 1405.32]
(1447.24, 1468.2]
(1510.12, 1531.08]
(1573, 1593.96]
(1635.88, 1656.84]
(1698.76, 1719.72]
(1761.64, 1782.6]
(1824.52, 1845.48]
(1887.4, 1908.36]
(1950.28, 1971.24]
(2013.16, 2034.12]
(2076.04, 2097]
Depth of nodes


Splay Tennis Winners Unordered (splay on add false)
number of nodes per set
14000
12000
10000
8000
6000
4000
2000
0
[0, 10]
(20, 30]
(40, 50]
(60, 70]
(80, 90]
(100, 110]
(120, 130]
(140, 150]
(160, 170]
(180, 190]
(200, 210]
(220, 230]
(240, 250]
(260, 270]
(280, 290]
(300, 310]
(320, 330]
(340, 350]
(360, 370]
(380, 390]
(400, 410]
(420, 430]
depth of nodes


Splay Tennis Winners Ordered (splay on add false)
number of nodes per set
3000
2500
2000
1500
1000
500
0
[0, 5]
(5, 10]
(10, 15]
(15, 20]
(20, 25]
(25, 30]
(30, 35]
(35, 40]
(40, 45]
(45, 50]
(50, 55]
(55, 60]
(60, 65]
(65, 70]
(70, 75]
(75, 80]
(80, 85]
(85, 90]
(90, 95]
depth of nodes