

Advanced Forest Planning

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Assignment 3 – Binary Search

I implemented this binary search scheduler in Python using only the Pandas library for data handling. Despite the simplicity of binary search, the fact that no solver libraries were used and the fact that I implemented a HarvestSchedule class for the sake of future projects made this assignment somewhat more laborious than others, however this labor will hopefully pay off for any other assignments that involve harvest scheduling can make use of the HarvestSchedule class and its methods.

Parameters were set as the following unless stated otherwise:

T = 11721	STAND_SIZE = 40	Min_gap = 100
N_PERIODS = 8	STEP_SIZE = 5	

My implementation includes adjacency constraints, only harvests complete stands, age constraints, and only harvests stands once across the time horizon. With all of these constraints, I found that for the default parameters used above, especially the target of 11721, I ran out of feasible stands to harvest in the later time periods. With a slight adjustment to the initial target I was able to complete the harvest for all time periods.

Below is the complete output of my program run with stands sorted by age and default parameters listed above.

Target increased: 23442
 Target adjusted downwards: 17581.5
 Target adjusted downwards: 14651.25
 Target adjusted downwards: 13186.125
 Target adjusted downwards: 12453.5625
 Target adjusted downwards: 12087.28125
 Target adjusted downwards: 11904.140625
 Target adjusted downwards: 11812.5703125
 Harvesting Stand 22 in Period 1 with volume 1244.0.
 Harvesting Stand 25 in Period 1 with volume 1200.0.
 Harvesting Stand 84 in Period 1 with volume 1224.0.
 Harvesting Stand 69 in Period 1 with volume 1156.0.
 Harvesting Stand 108 in Period 1 with volume 1180.0.
 Harvesting Stand 48 in Period 1 with volume 1224.0.
 Harvesting Stand 60 in Period 1 with volume 1136.0.
 Harvesting Stand 19 in Period 1 with volume 1116.0.
 Harvesting Stand 104 in Period 1 with volume 1112.0.
 Harvesting Stand 109 in Period 1 with volume 1132.0.
 Harvesting Stand 68 in Period 2 with volume 1416.0.
 Harvesting Stand 56 in Period 2 with volume 1284.0.
 Harvesting Stand 92 in Period 2 with volume 1332.0.

Harvesting Stand 70 in Period 2 with volume 1308.0.
Harvesting Stand 14 in Period 2 with volume 1156.0.
Harvesting Stand 44 in Period 2 with volume 1180.0.
Harvesting Stand 49 in Period 2 with volume 1140.0.
Harvesting Stand 107 in Period 2 with volume 1180.0.
Harvesting Stand 95 in Period 2 with volume 1160.0.
Harvesting Stand 111 in Period 2 with volume 1204.0.
Harvesting Stand 72 in Period 2 with volume 1176.0.
Harvesting Stand 74 in Period 2 with volume 1200.0.
Harvesting Stand 11 in Period 2 with volume 1156.0.
Harvesting Stand 4 in Period 2 with volume 1136.0.
Harvesting Stand 54 in Period 2 with volume 1052.0.
Harvesting Stand 43 in Period 2 with volume 1012.0.
Harvesting Stand 46 in Period 2 with volume 1032.0.
Harvesting Stand 100 in Period 2 with volume 1072.0.
Harvesting Stand 112 in Period 2 with volume 1092.0.
Harvesting Stand 113 in Period 2 with volume 1112.0.
Harvesting Stand 81 in Period 2 with volume 1016.0.
Harvesting Stand 39 in Period 3 with volume 1304.0.
Harvesting Stand 67 in Period 3 with volume 1332.0.
Harvesting Stand 89 in Period 3 with volume 1376.0.
Harvesting Stand 42 in Period 3 with volume 1288.0.
Harvesting Stand 62 in Period 3 with volume 1308.0.
Harvesting Stand 13 in Period 3 with volume 1268.0.
Harvesting Stand 10 in Period 3 with volume 1244.0.
Harvesting Stand 75 in Period 3 with volume 1160.0.
Harvesting Stand 50 in Period 3 with volume 1116.0.
Harvesting Stand 51 in Period 3 with volume 1140.0.
Harvesting Stand 33 in Period 3 with volume 1200.0.
Harvesting Stand 2 in Period 3 with volume 1176.0.
Harvesting Stand 55 in Period 3 with volume 1032.0.
Harvesting Stand 45 in Period 3 with volume 1012.0.
Harvesting Stand 102 in Period 3 with volume 1052.0.
Harvesting Stand 38 in Period 4 with volume 1304.0.
Harvesting Stand 52 in Period 4 with volume 1308.0.
Harvesting Stand 99 in Period 4 with volume 1024.0.
Harvesting Stand 76 in Period 4 with volume 1004.0.
Harvesting Stand 28 in Period 4 with volume 896.0.
Harvesting Stand 57 in Period 4 with volume 844.0.
Harvesting Stand 73 in Period 4 with volume 860.0.
Harvesting Stand 106 in Period 4 with volume 880.0.
Harvesting Stand 31 in Period 4 with volume 664.0.
Harvesting Stand 32 in Period 4 with volume 680.0.
Harvesting Stand 87 in Period 4 with volume 584.0.
Harvesting Stand 103 in Period 4 with volume 600.0.
Harvesting Stand 27 in Period 4 with volume 568.0.
Harvesting Stand 71 in Period 4 with volume 508.0.
Harvesting Stand 24 in Period 4 with volume 492.0.

Harvesting Stand 65 in Period 4 with volume 504.0.
Harvesting Stand 94 in Period 4 with volume 516.0.
Harvesting Stand 96 in Period 4 with volume 380.0.
Harvesting Stand 82 in Period 4 with volume 372.0.
Harvesting Stand 78 in Period 4 with volume 332.0.
Harvesting Stand 37 in Period 5 with volume 1616.0.
Harvesting Stand 41 in Period 5 with volume 560.0.
Harvesting Stand 8 in Period 5 with volume 548.0.
Harvesting Stand 63 in Period 5 with volume 440.0.
Harvesting Stand 91 in Period 5 with volume 464.0.
Harvesting Stand 29 in Period 5 with volume 428.0.
Harvesting Stand 80 in Period 5 with volume 452.0.
Harvesting Stand 97 in Period 5 with volume 476.0.
Harvesting Stand 16 in Period 5 with volume 436.0.
Harvesting Stand 77 in Period 5 with volume 472.0.
Harvesting Stand 6 in Period 5 with volume 424.0.
Harvesting Stand 36 in Period 5 with volume 448.0.
Harvesting Stand 61 in Period 5 with volume 460.0.
Harvesting Stand 21 in Period 5 with volume 340.0.
Harvesting Stand 53 in Period 5 with volume 360.0.
Harvesting Stand 64 in Period 5 with volume 372.0.
Harvesting Stand 101 in Period 5 with volume 392.0.
Harvesting Stand 90 in Period 5 with volume 380.0.
Harvesting Stand 93 in Period 5 with volume 380.0.
Harvesting Stand 83 in Period 5 with volume 372.0.
Harvesting Stand 110 in Period 5 with volume 392.0.
Harvesting Stand 20 in Period 5 with volume 352.0.
Harvesting Stand 17 in Period 5 with volume 340.0.
Harvesting Stand 35 in Period 6 with volume 568.0.
Harvesting Stand 5 in Period 6 with volume 532.0.
Harvesting Stand 40 in Period 6 with volume 576.0.
Harvesting Stand 30 in Period 6 with volume 548.0.
Harvesting Stand 1 in Period 6 with volume 560.0.
Harvesting Stand 105 in Period 6 with volume 520.0.
Harvesting Stand 79 in Period 6 with volume 532.0.
Harvesting Stand 114 in Period 6 with volume 492.0.
Harvesting Stand 12 in Period 6 with volume 464.0.
Harvesting Stand 86 in Period 6 with volume 476.0.
Harvesting Stand 26 in Period 6 with volume 348.0.
Harvesting Stand 58 in Period 6 with volume 360.0.
Harvesting Stand 98 in Period 6 with volume 372.0.
Harvesting Stand 88 in Period 6 with volume 360.0.
Harvesting Stand 9 in Period 6 with volume 340.0.
Harvesting Stand 47 in Period 6 with volume 352.0.
Harvesting Stand 3 in Period 6 with volume 332.0.
Harvesting Stand 7 in Period 7 with volume 400.0.
Harvesting Stand 85 in Period 7 with volume 416.0.
Harvesting Stand 66 in Period 7 with volume 404.0.

Harvesting Stand 23 in Period 7 with volume 372.0.
 Harvesting Stand 18 in Period 8 with volume 300.0.
 Harvesting Stand 15 in Period 8 with volume 484.0.
 Harvesting Stand 59 in Period 8 with volume 400.0.
 Harvesting Stand 34 in Period 8 with volume 292.0.

Harvest Volume by Period:

Period 1: Total Harvest Volume = 11724.0
 Period 2: Total Harvest Volume = 24416.0
 Period 3: Total Harvest Volume = 18008.0
 Period 4: Total Harvest Volume = 14320.0
 Period 5: Total Harvest Volume = 10904.0
 Period 6: Total Harvest Volume = 7732.0
 Period 7: Total Harvest Volume = 1592.0
 Period 8: Total Harvest Volume = 1476.0

This time, the complete output when the target is adjusted slightly to 10500 from 11721, leaving all other parameters the same.

Target increased: 21000

Target adjusted downwards: 15750.0

Target adjusted downwards: 13125.0

Target adjusted downwards: 11812.5

Target adjusted downwards: 11156.25

Target adjusted downwards: 10828.125

Target adjusted downwards: 10664.0625

Target adjusted downwards: 10582.03125

Harvesting Stand 22 in Period 1 with volume 1244.0.
 Harvesting Stand 25 in Period 1 with volume 1200.0.
 Harvesting Stand 84 in Period 1 with volume 1224.0.
 Harvesting Stand 69 in Period 1 with volume 1156.0.
 Harvesting Stand 108 in Period 1 with volume 1180.0.
 Harvesting Stand 48 in Period 1 with volume 1224.0.
 Harvesting Stand 60 in Period 1 with volume 1136.0.
 Harvesting Stand 19 in Period 1 with volume 1116.0.
 Harvesting Stand 104 in Period 1 with volume 1112.0.
 Harvesting Stand 109 in Period 2 with volume 1460.0.
 Harvesting Stand 68 in Period 2 with volume 1416.0.
 Harvesting Stand 56 in Period 2 with volume 1284.0.
 Harvesting Stand 92 in Period 2 with volume 1332.0.
 Harvesting Stand 70 in Period 2 with volume 1308.0.
 Harvesting Stand 14 in Period 2 with volume 1156.0.
 Harvesting Stand 44 in Period 2 with volume 1180.0.
 Harvesting Stand 49 in Period 2 with volume 1140.0.
 Harvesting Stand 107 in Period 2 with volume 1180.0.
 Harvesting Stand 95 in Period 2 with volume 1160.0.
 Harvesting Stand 111 in Period 2 with volume 1204.0.
 Harvesting Stand 72 in Period 2 with volume 1176.0.
 Harvesting Stand 74 in Period 2 with volume 1200.0.

Harvesting Stand 11 in Period 2 with volume 1156.0.
Harvesting Stand 4 in Period 2 with volume 1136.0.
Harvesting Stand 54 in Period 2 with volume 1052.0.
Harvesting Stand 43 in Period 2 with volume 1012.0.
Harvesting Stand 46 in Period 2 with volume 1032.0.
Harvesting Stand 39 in Period 3 with volume 1304.0.
Harvesting Stand 100 in Period 3 with volume 1396.0.
Harvesting Stand 112 in Period 3 with volume 1416.0.
Harvesting Stand 113 in Period 3 with volume 1440.0.
Harvesting Stand 67 in Period 3 with volume 1332.0.
Harvesting Stand 81 in Period 3 with volume 1352.0.
Harvesting Stand 89 in Period 3 with volume 1376.0.
Harvesting Stand 42 in Period 3 with volume 1288.0.
Harvesting Stand 62 in Period 3 with volume 1308.0.
Harvesting Stand 13 in Period 3 with volume 1268.0.
Harvesting Stand 10 in Period 3 with volume 1244.0.
Harvesting Stand 75 in Period 3 with volume 1160.0.
Harvesting Stand 50 in Period 4 with volume 1428.0.
Harvesting Stand 51 in Period 4 with volume 1452.0.
Harvesting Stand 33 in Period 4 with volume 1528.0.
Harvesting Stand 2 in Period 4 with volume 1504.0.
Harvesting Stand 38 in Period 4 with volume 1304.0.
Harvesting Stand 55 in Period 4 with volume 1348.0.
Harvesting Stand 45 in Period 4 with volume 1328.0.
Harvesting Stand 102 in Period 4 with volume 1372.0.
Harvesting Stand 52 in Period 4 with volume 1308.0.
Harvesting Stand 99 in Period 4 with volume 1024.0.
Harvesting Stand 37 in Period 5 with volume 1616.0.
Harvesting Stand 76 in Period 5 with volume 1332.0.
Harvesting Stand 28 in Period 5 with volume 1240.0.
Harvesting Stand 57 in Period 5 with volume 1176.0.
Harvesting Stand 73 in Period 5 with volume 1200.0.
Harvesting Stand 106 in Period 5 with volume 1220.0.
Harvesting Stand 31 in Period 5 with volume 972.0.
Harvesting Stand 32 in Period 5 with volume 992.0.
Harvesting Stand 87 in Period 5 with volume 904.0.
Harvesting Stand 103 in Period 5 with volume 920.0.
Harvesting Stand 27 in Period 5 with volume 884.0.
Harvesting Stand 71 in Period 6 with volume 1136.0.
Harvesting Stand 24 in Period 6 with volume 1112.0.
Harvesting Stand 65 in Period 6 with volume 1132.0.
Harvesting Stand 94 in Period 6 with volume 1152.0.
Harvesting Stand 96 in Period 6 with volume 940.0.
Harvesting Stand 82 in Period 6 with volume 920.0.
Harvesting Stand 78 in Period 6 with volume 856.0.
Harvesting Stand 41 in Period 6 with volume 880.0.
Harvesting Stand 8 in Period 6 with volume 860.0.
Harvesting Stand 63 in Period 6 with volume 712.0.

Harvesting Stand 91 in Period 6 with volume 744.0.
Harvesting Stand 29 in Period 6 with volume 696.0.
Harvesting Stand 80 in Period 6 with volume 728.0.
Harvesting Stand 97 in Period 7 with volume 1092.0.
Harvesting Stand 16 in Period 7 with volume 1024.0.
Harvesting Stand 77 in Period 7 with volume 1084.0.
Harvesting Stand 6 in Period 7 with volume 1004.0.
Harvesting Stand 36 in Period 7 with volume 1044.0.
Harvesting Stand 61 in Period 7 with volume 1064.0.
Harvesting Stand 21 in Period 7 with volume 868.0.
Harvesting Stand 53 in Period 7 with volume 904.0.
Harvesting Stand 64 in Period 7 with volume 920.0.
Harvesting Stand 101 in Period 7 with volume 960.0.
Harvesting Stand 90 in Period 7 with volume 940.0.
Harvesting Stand 35 in Period 8 with volume 1200.0.
Harvesting Stand 93 in Period 8 with volume 1288.0.
Harvesting Stand 83 in Period 8 with volume 1264.0.
Harvesting Stand 110 in Period 8 with volume 1308.0.
Harvesting Stand 20 in Period 8 with volume 1224.0.
Harvesting Stand 17 in Period 8 with volume 1204.0.
Harvesting Stand 5 in Period 8 with volume 1180.0.
Harvesting Stand 40 in Period 8 with volume 1244.0.
Harvesting Stand 30 in Period 8 with volume 1200.0.
Harvest Volume by Period:

Period 1: Total Harvest Volume = 10592.0

Period 2: Total Harvest Volume = 21584.0

Period 3: Total Harvest Volume = 15884.0

Period 4: Total Harvest Volume = 13596.0

Period 5: Total Harvest Volume = 12456.0

Period 6: Total Harvest Volume = 11868.0

Period 7: Total Harvest Volume = 10904.0

Period 8: Total Harvest Volume = 11112.0