ESO207A
Assignment 3

Rahul Sethi (190668)
Rohan Baijal (190714)
Vivek Kumar Singh (190988)

Q1 (d)

Height of an ordinary BST R is: 100, which greatly deviates from that of a perfectly balanced BST (note $\log_2 100 \approx 7$). Here, the numbers are inserted in ascending order - which results in a right-linear BST.

Height of Tree 0 is: 12
Height of Tree 1 is: 17
Height of Tree 2 is: 13
Height of Tree 3 is: 12
Height of Tree 4 is: 12

Average height of trees is: 13 (close to $\log_2 100 \approx 7$, much less than 100).

Average height turns out to be $\mathcal{O}(\log n)$ due to randomization of priority in treaps.

Q1 (e)

Height of an ordinary BST R is: 5, which is that of a perfectly balanced BST (note $\log_2 24 \approx 5$). This is due to insertion of elements in just the right order to construct a perfectly balanced BST.

Height of Tree 0 is: 11
Height of Tree 1 is: 9
Height of Tree 2 is: 7
Height of Tree 3 is: 8
Height of Tree 4 is: 7

Average height of trees is: 8, which is *slightly worse than* that of a perfectly balanced BST, i.e. 5, but much better than 24 (right-linear BST).

Average height turns out to be $\mathcal{O}(\log n)$ due to randomization of priority in treaps.

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Part (d):
Height of an ordinary BST R is: 100

Height of Tree 0 is: 12
Height of Tree 1 is: 17
Height of Tree 2 is: 13
Height of Tree 3 is: 12
Height of Tree 4 is: 12
Average height of the trees is: 13

Part (e):
Height of an ordinary BST R is: 5

Height of Tree 0 is: 11
Height of Tree 1 is: 9
Height of Tree 2 is: 7
Height of Tree 3 is: 8
Height of Tree 4 is: 7
Average height of the trees is: 8
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Test Run

Note: The expected height of a random BST is $\mathcal{O}(\log n)$ (CLRS). Here, we are working with distinct keys and distinct priorities. Randomizing over priorities is essentially equivalent to creating a random BST.