Name : Lucky Laurens

Discord : Luckymai

Group : OUTPLAY

**Obscure Binary Search Trees:**

**Knight’s Travails:**

**Text Editor:**

**Tree Simulations:**

**AVL 2-3 Tree RB Tree**

1. Insert 80:

  

Insert 35:

35 is less than 80, so go left.

Diagram

Description automatically generated  Diagram

Description automatically generated

Insert 20:

Diagram

Description automatically generated Diagram

Description automatically generated Diagram

Description automatically generated

20 is less than 35, go left. Root changed into only one key go left.

and has 2 children

Diagram

Description automatically generated Diagram

Description automatically generated

Do right rotation recolor and rotation

Insert 100:

Diagram

Description automatically generated Diagram

Description automatically generated Diagram

Description automatically generated

100 is more than 80, go right. recolor the parent&uncle.

Insert 25 :

Diagram

Description automatically generated Diagram

Description automatically generated Diagram

Description automatically generated

25 is less than 35, go left

25 is more than 20, go right.

Insert 30:

Diagram

Description automatically generated A picture containing text, clock

Description automatically generated Diagram

Description automatically generated

30 is less than 35, more than 20, more than 25.

A picture containing clock, lawn mower, clipart

Description automatically generated A picture containing clock, clipart, lawn mower

Description automatically generated

Do left rotation do left rotation and recolor.

Insert 45:

A picture containing clock, clipart

Description automatically generated A picture containing text, clock

Description automatically generated A picture containing clipart, clock, lawn mower

Description automatically generated

45 is more than 35 and less than 80.

Diagram

Description automatically generated

3 children is not allowed, so we pushing up a key

A picture containing text, clock

Description automatically generated

3 children is not allowed, so we pushing up a key again.

Insert 40:

Diagram

Description automatically generatedA picture containing text, clock

Description automatically generatedDiagram

Description automatically generated

40 is more than 35, less than 80, less than 45.

Diagram

Description automatically generated

Recoloring

Insert 50:

Diagram

Description automatically generatedDiagram

Description automatically generatedDiagram

Description automatically generated

50 is more than 35, less than 80, and more than 45.

A picture containing text, clock

Description automatically generated

3 children is not allowed, so we pushing up a key into parent.

Insert 37:

Diagram

Description automatically generatedA picture containing text, clock, clipart

Description automatically generated Diagram

Description automatically generated

37 is more than 35, less than 80, less than 45, less than 40.

Diagram

Description automatically generated Diagram

Description automatically generated

Do single right rotation on 40 45 and 80. Recolor the parent, uncle, and grandparent

A picture containing clock, clipart

Description automatically generated

because there are 2 reds in a row, do right rotation on 45

A picture containing clipart, clock

Description automatically generated

there are still 2 reds in a row, do right rotation on 45

A picture containing clock, clipart

Description automatically generated

Recoloring

**AVL 2-3 Tree RB Tree**

Remove 35

Diagram

Description automatically generated Diagram

Description automatically generated A picture containing clock, clipart

Description automatically generated

Looking for the predecessor to replace 35.

A picture containing text, clock, clipart

Description automatically generated

Do rotation.

Remove 25

Diagram

Description automatically generated A picture containing text, clock, clipart

Description automatically generated A picture containing clock, clipart

Description automatically generated

Search 25 and directly delete it.

Diagram

Description automatically generated A picture containing clock, clipart, lawn mower

Description automatically generated

Do rotation on 45, because the recolor node 20 into black.

different level is more than 1

Remove 30

Diagram

Description automatically generated A picture containing text, clock, clipart

Description automatically generated A picture containing clock, clipart

Description automatically generated

Replace 30 with it’s predecessor.

Diagram

Description automatically generated Diagram

Description automatically generated A picture containing clock, clipart

Description automatically generated

Do a right- left rotation. Do rotation on 20,37 and 40. Do right rotation.

A picture containing clock, clipart, lawn mower

Description automatically generated

Do left rotation and recolor.

Remove 45

A picture containing clock, clipart

Description automatically generated A picture containing text, clock

Description automatically generated Diagram

Description automatically generated

Search for the predecessor.

A picture containing text, clock, clipart

Description automatically generated

Move 37.

Diagram

Description automatically generated

Move 40, and merge 20 and 37.

A picture containing text, clock

Description automatically generated

Merge 40 and 80.

Remove 80

Diagram

Description automatically generated A picture containing text, clock

Description automatically generated Diagram

Description automatically generated

Find the predecessor of 80

A picture containing text, clock

Description automatically generated

Move 40 into child, and up 37 into parent.

1. Insert

**Disjoint Sets and Graphs:**

* Prim’s Algorithm

Chart

Description automatically generated

Chart

Description automatically generated

Chart, radar chart

Description automatically generated

Chart, radar chart

Description automatically generated

Chart, radar chart

Description automatically generated

Chart, radar chart

Description automatically generated

Chart, radar chart

Description automatically generated

Chart, radar chart

Description automatically generated

Minimum spanning tree = 2 + 3 + 5 + 1 + 6 +7 + 8 + 12 = 44

* Kruskal Algorithm

Chart

Description automatically generated

Chart, radar chart

Description automatically generated

Chart

Description automatically generated

Chart, radar chart

Description automatically generated

Chart, radar chart

Description automatically generated

Chart, radar chart

Description automatically generated

Chart, radar chart

Description automatically generated

Chart, radar chart

Description automatically generated

Minimum spanning tree = 2 + 3 + 5 + 1 + 6 +7 + 8 + 12 = 44

* Shortest Path from I to A

Chart

Description automatically generated

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | A | B | C | D | E | F | G | H | I |
| I | INF | INF | INF | INF | INF | 18I | 2 I | 4 I | 0 I |
| G | INF | INF | INF | 19G | 13G | 16G | 2 I | 4 I | X |
| H | INF | INF | 5H | 19G | 9H | 16G | X | 4 I | X |
| C | 11C | 18C | 5H | 19G | 9H | 16G | X | X | X |
| E | 11C | 18C | X | 19G | 9H | 16G | X | X | X |
| A | 11C | 18C | X | 19G | X | 16G | X | X | X |

I -> G = 2

I -> H = 4

I -> H -> C = 5

I -> H -> E = 9

I -> H -> C -> A = 11

So, the sortest path from I to A is 11.

* Shortest Path from F to C

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | A | B | C | D | E | F | G | H | I |
| F | INF | 12F | INF | 16F | INF | 0F | 14F | INF | 18F |
| B | 19B | 12F | 25B | 16F | INF | X | 14F | INF | 18F |
| G | 19B | X | 25B | 16F | 25G | X | 14F | 17G | 16G |
| D | 19B | X | 25B | 16F | 25G | X | X | 17G | 16G |
| I | 19B | X | 25B | X | 25G | X | X | 17G | 16G |
| H | 19B | X | 18H | X | 22H | X | X | 17G | X |
| C | 19B | X | 18H | X | 22H | X | X | X | X |

F->B = 12

F->G = 14

F->D = 16

F->G->I= 16

F->G->H = 17

F->G->H->C = 18

So, the shortest path from F to C is 18.