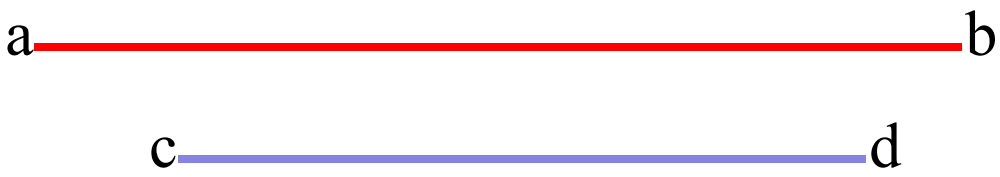
Interval Heaps

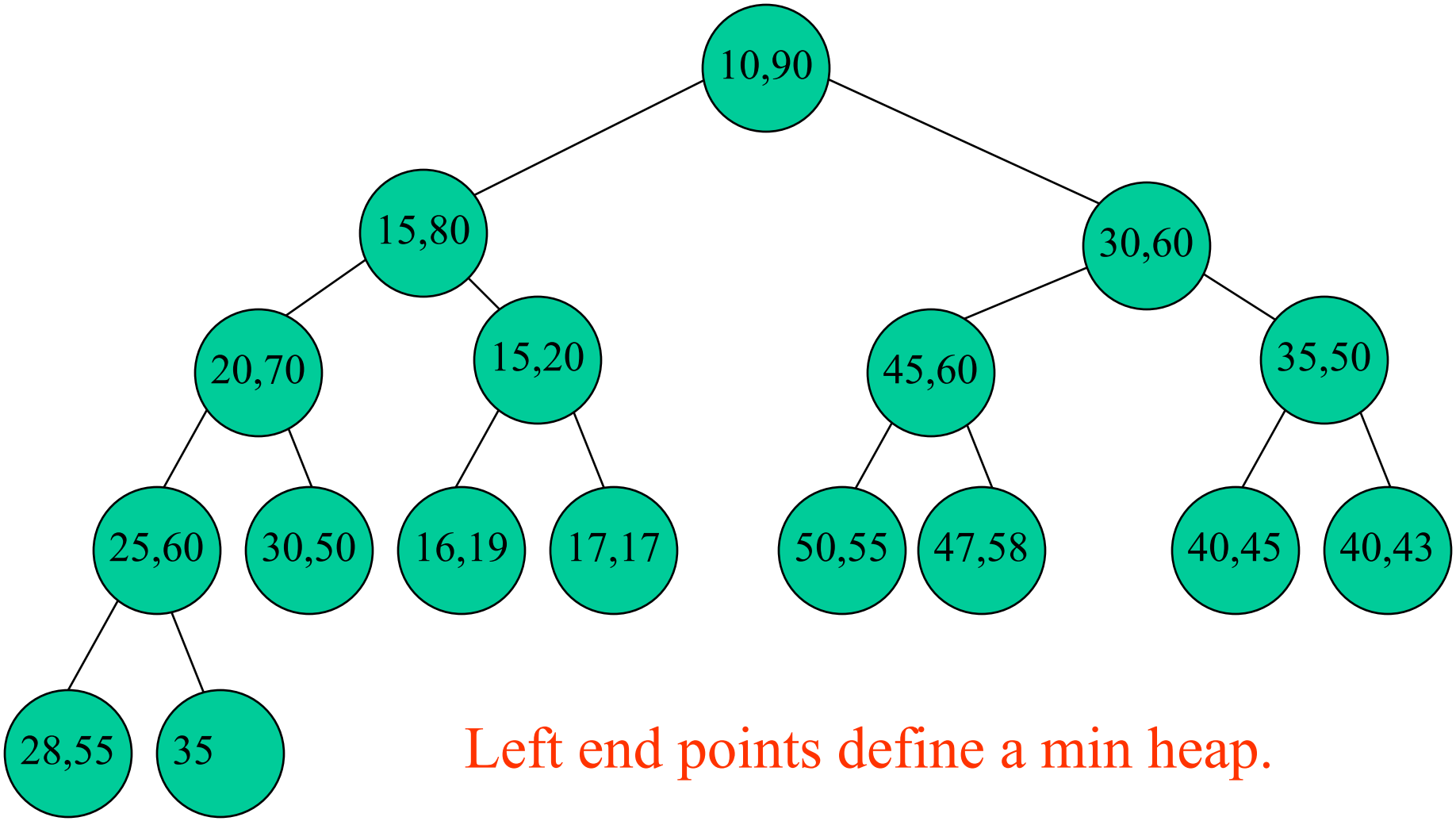
- Complete binary tree.
- Each node (except possibly last one) has 2 elements.
- Last node has 1 or 2 elements.
- Let a and b be the elements in a node P, a <= b.
- [a, b] is the interval represented by P.
- The interval represented by a node that has just one element a is [a, a].
- The interval [c, d] is contained in interval [a, b] iff a <= c <= d <= b.
- In an interval heap each node's (except for root) interval is contained in that of its parent.

Interval



- [c,d] is contained in [a,b]
- a <= c
- d <= b

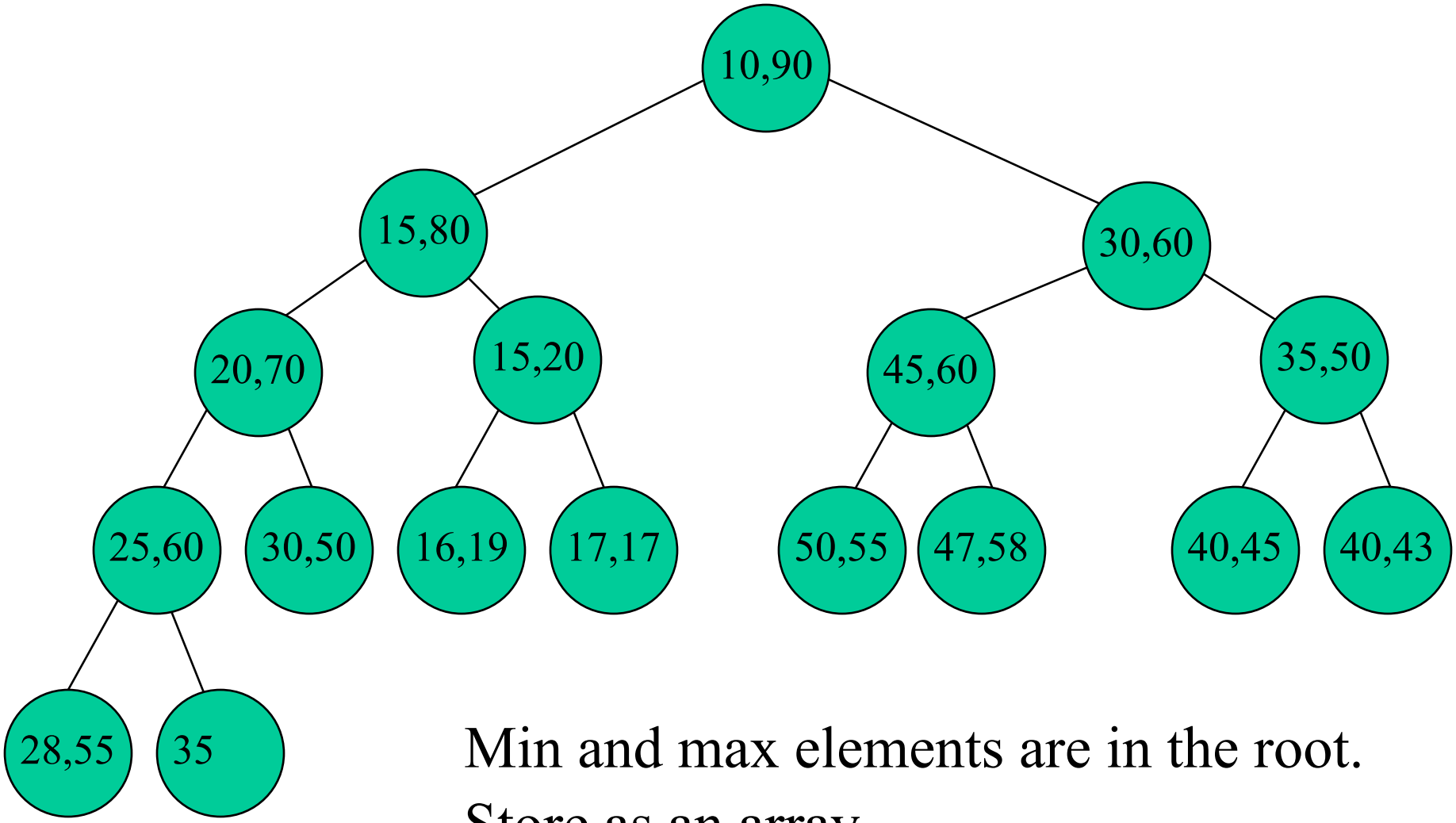
Example Interval Heap



Left end points define a min heap.

Right end points define a max heap.

Example Interval Heap

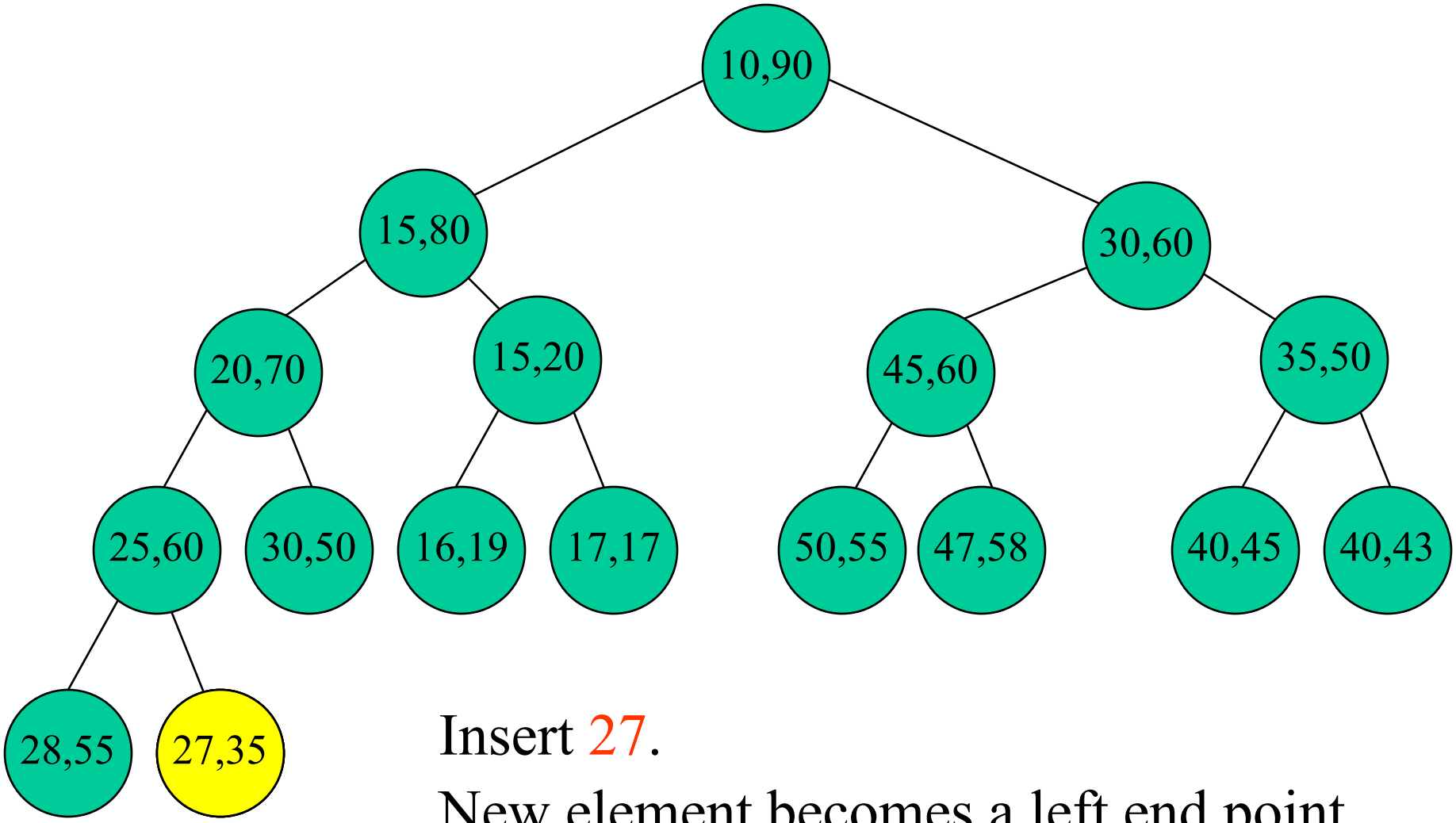


Min and max elements are in the root.

Store as an array.

Height is ~$\log_2 n$.

Insert An Element

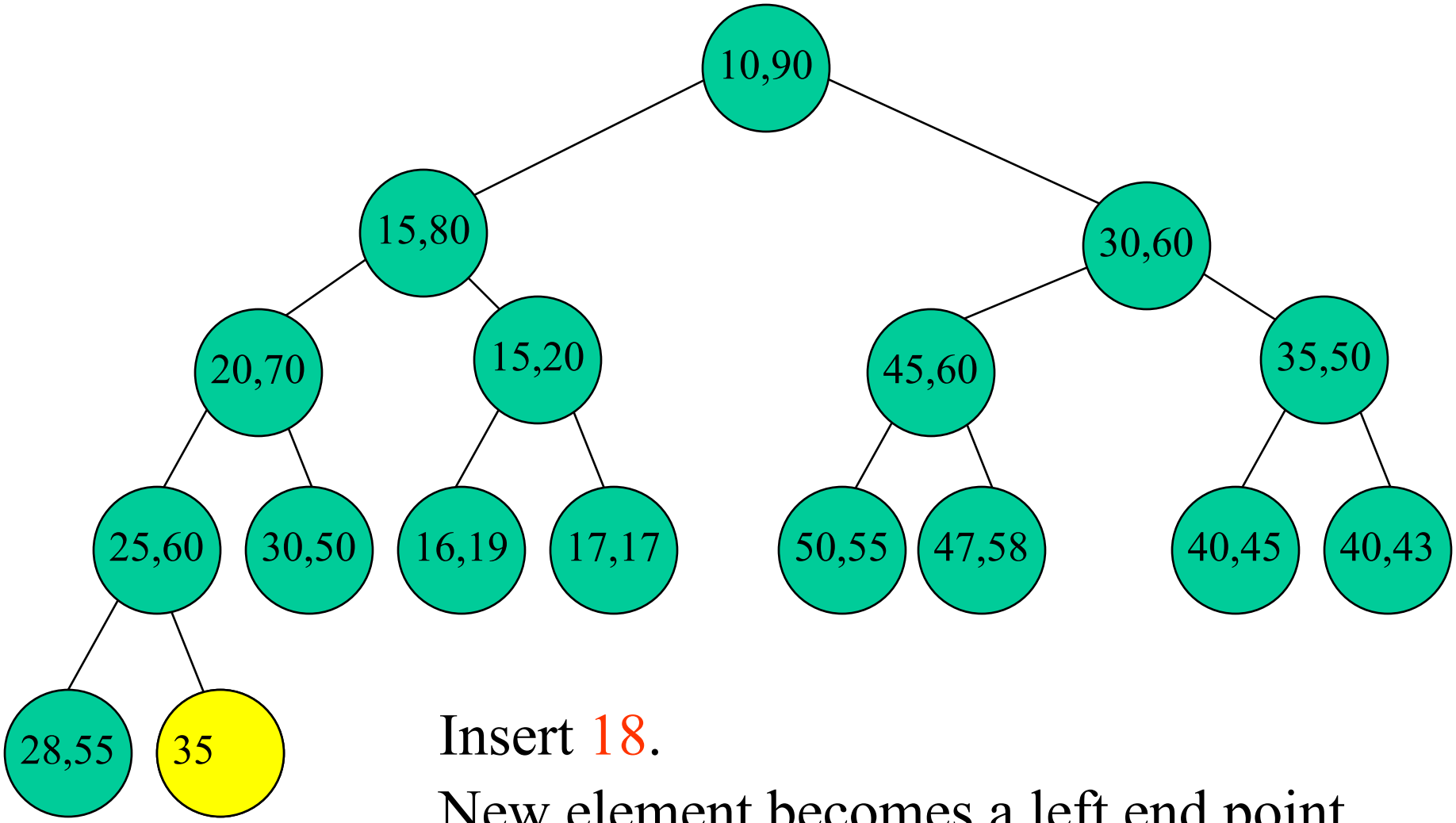


Insert 27.

New element becomes a left end point.

Insert new element into min heap.

Another Insert

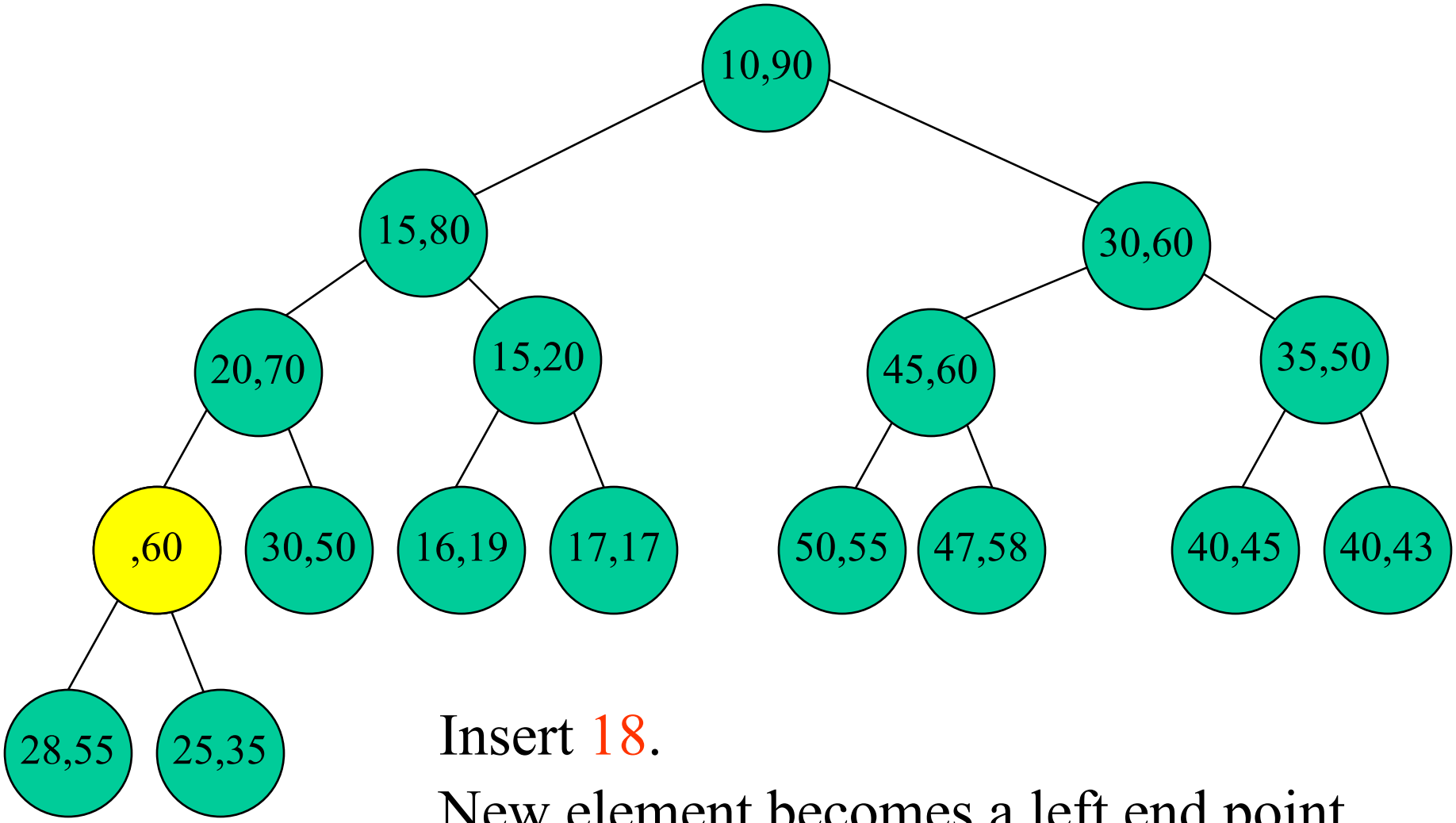


Insert 18.

New element becomes a left end point.

Insert new element into min heap.

Another Insert

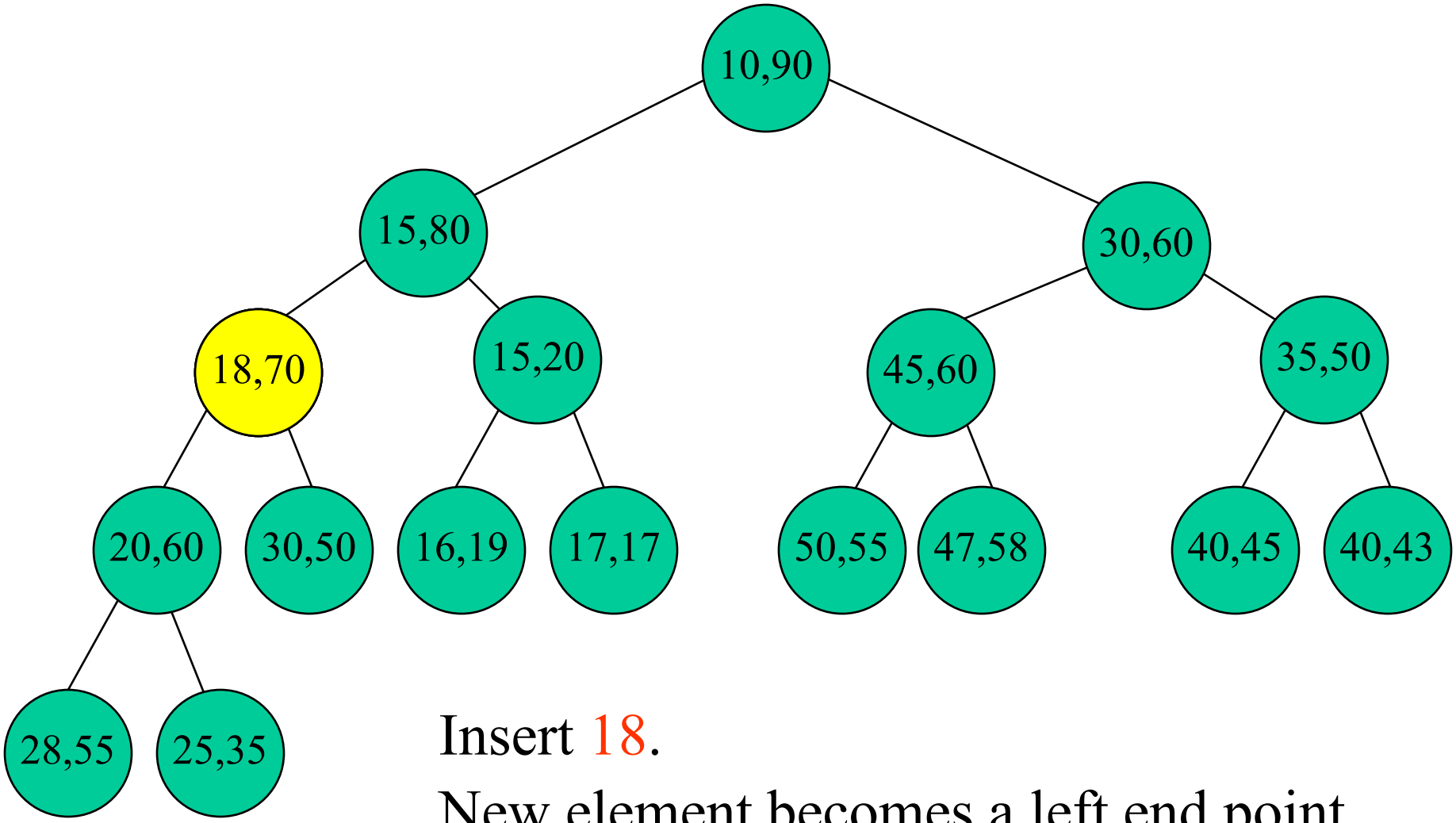


Insert 18.

New element becomes a left end point.

Insert new element into min heap.

Another Insert

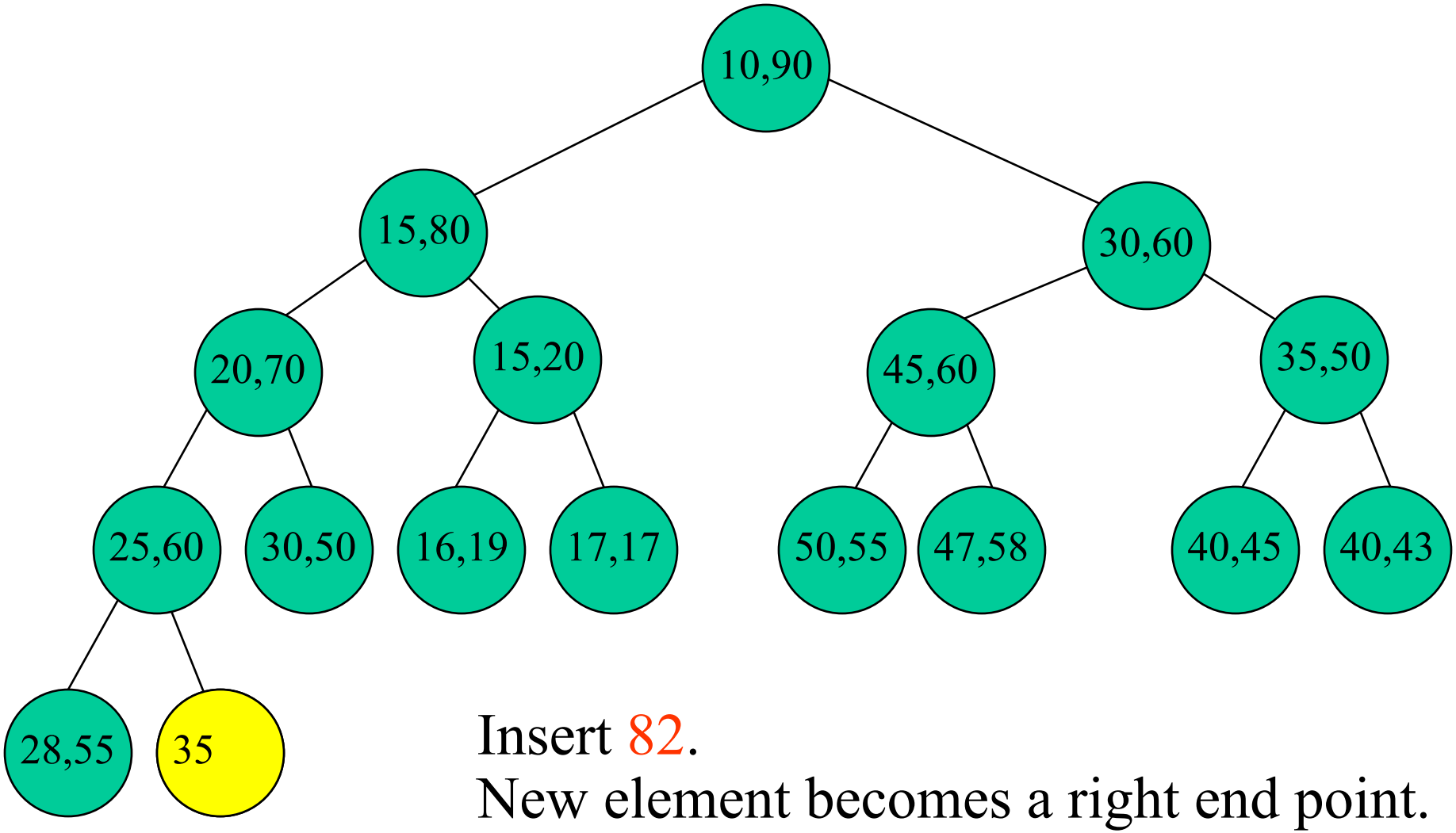


Insert 18.

New element becomes a left end point.

Insert new element into min heap.

Yet Another Insert

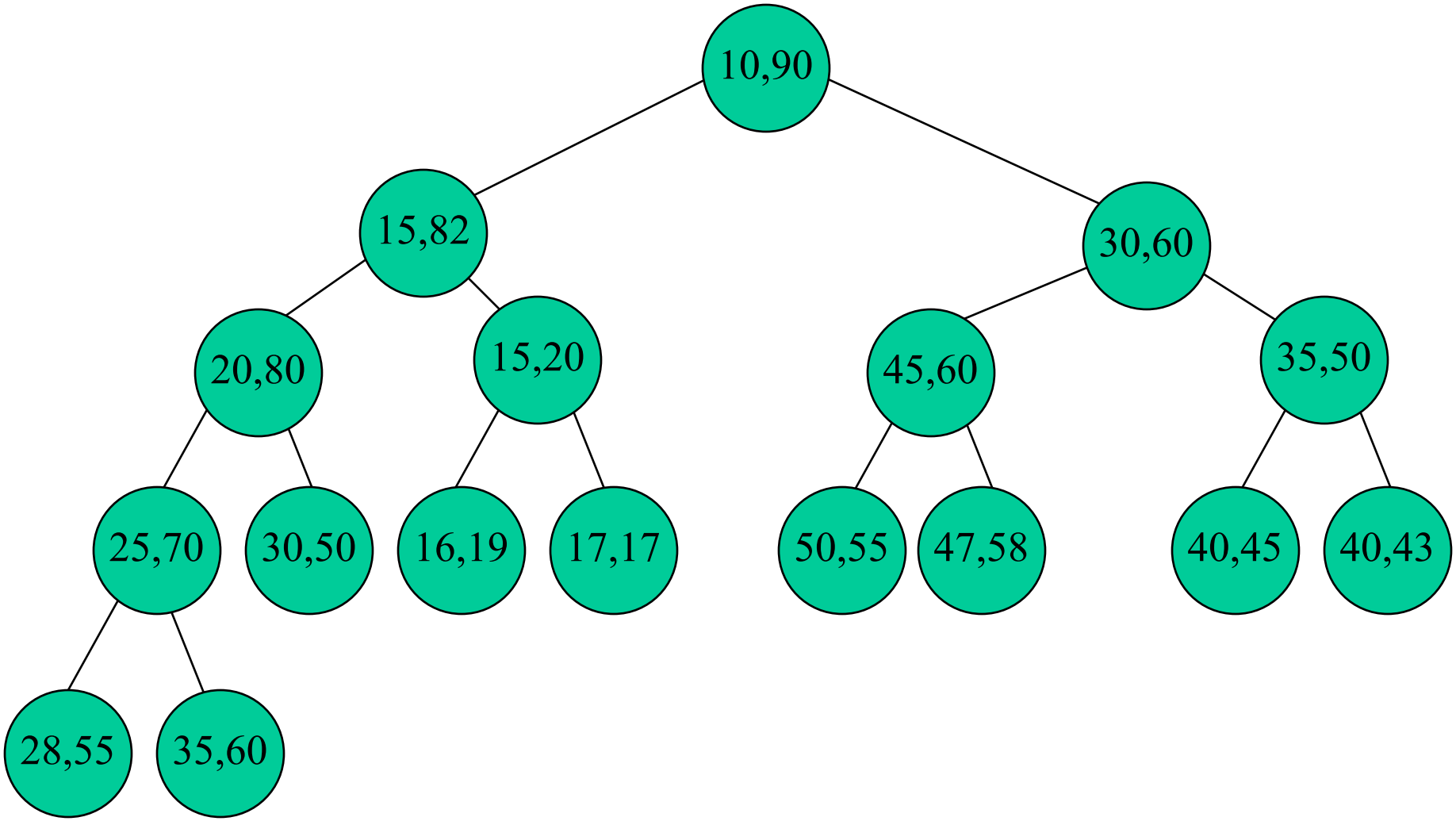


Insert 82.

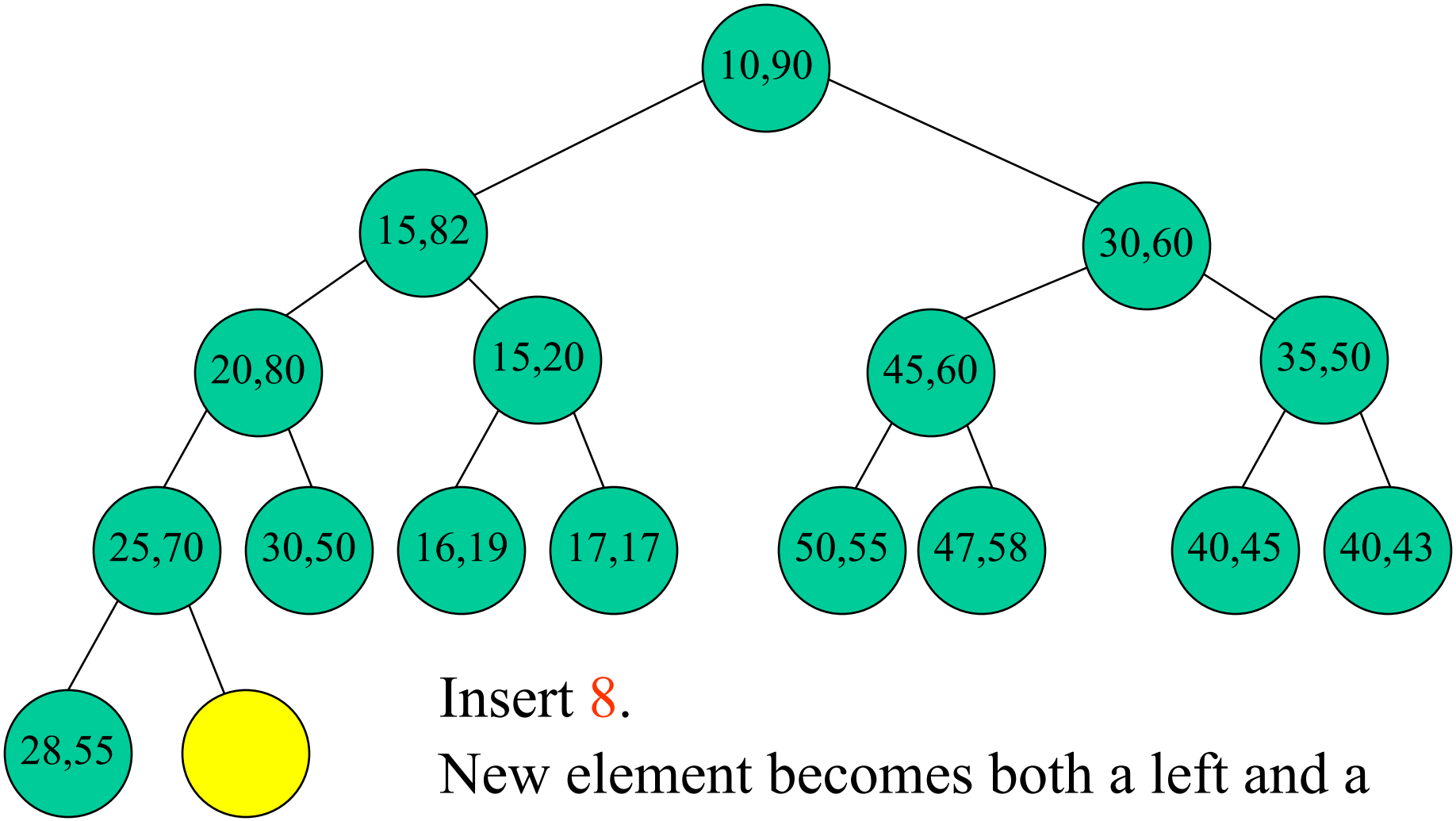
New element becomes a right end point.

Insert new element into max heap.

After 82 Inserted



One More Insert Example

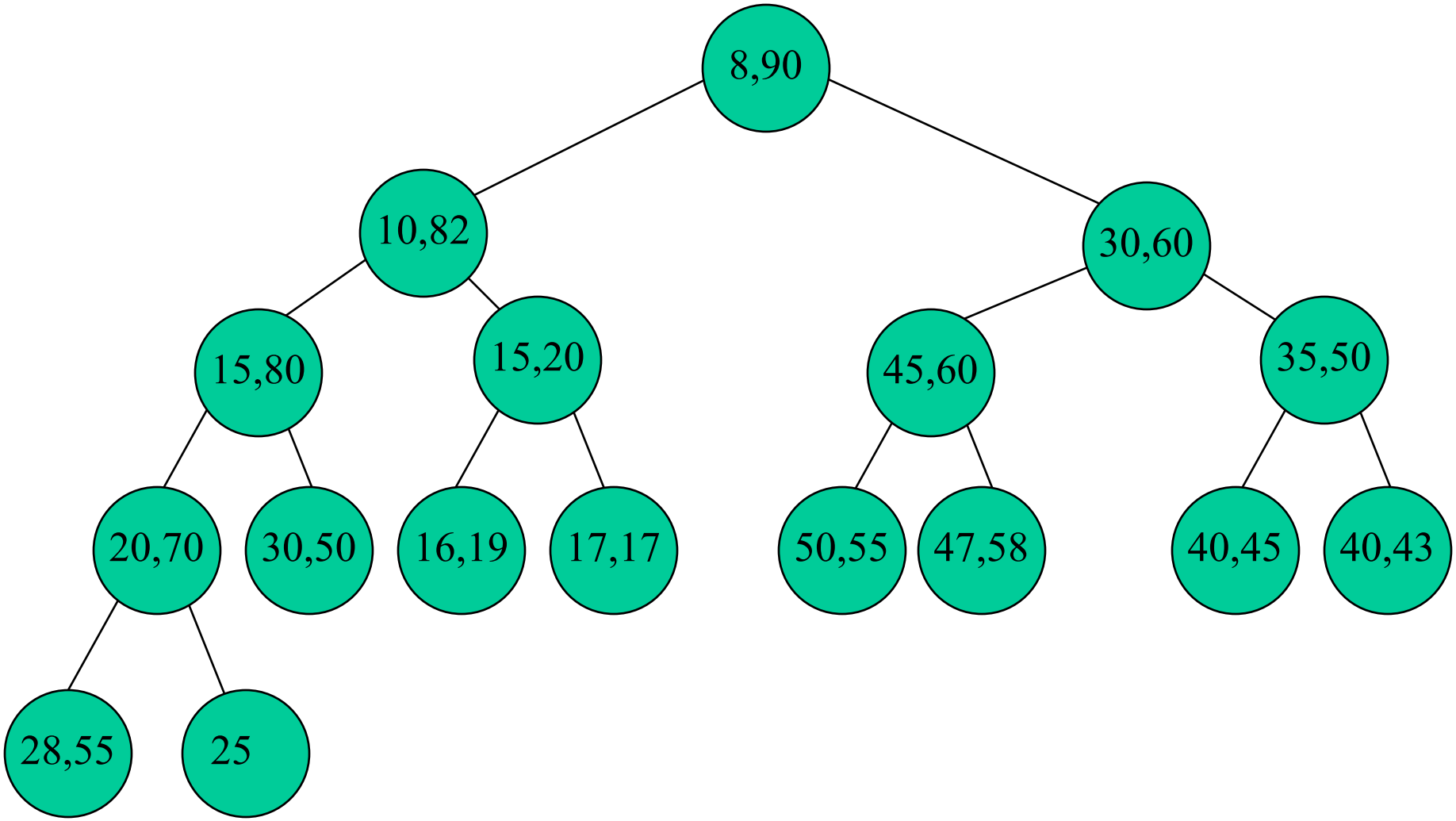


Insert 8.

New element becomes both a left and a right end point.

Insert new element into min heap.

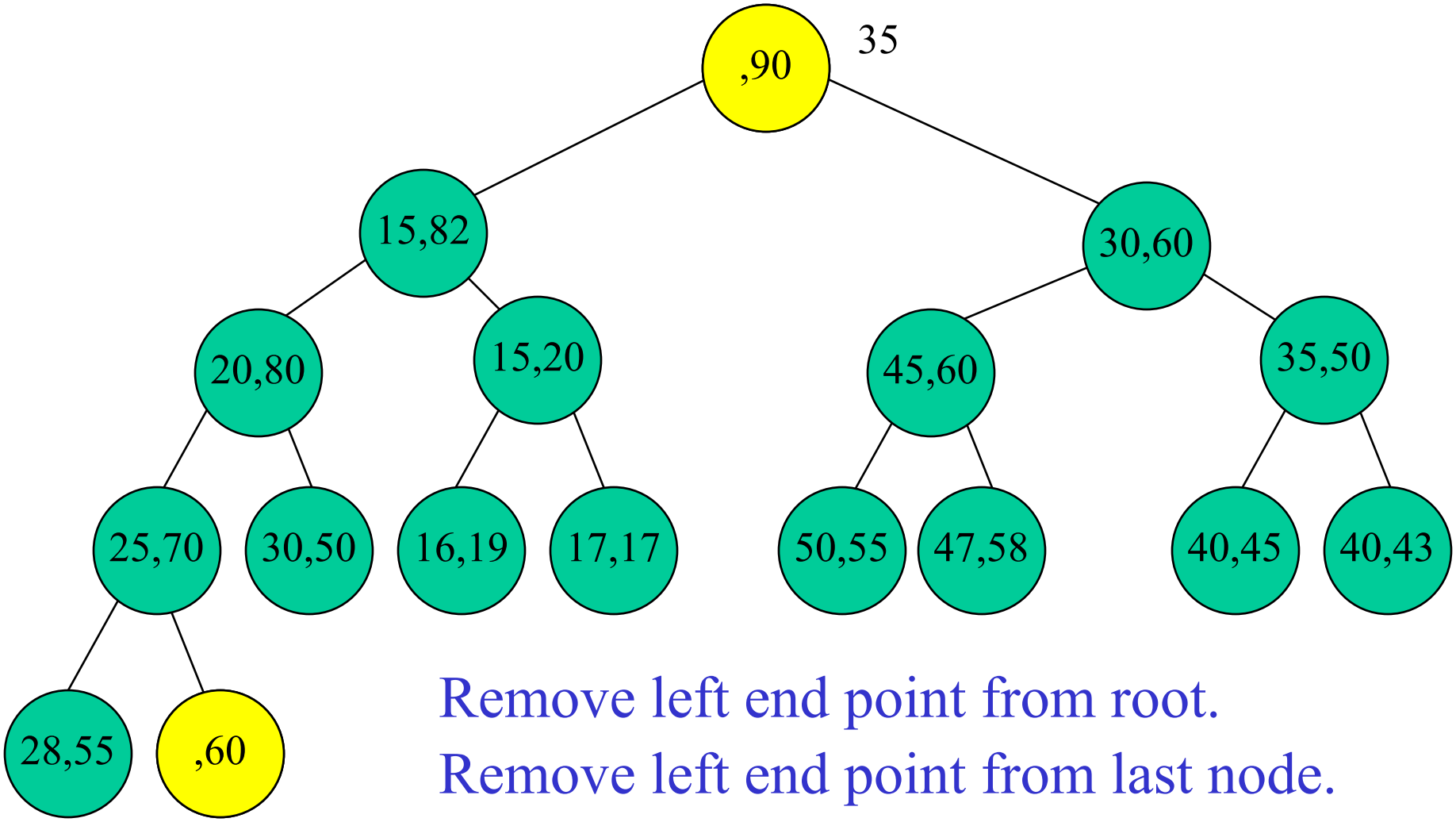
After 8 Is Inserted



Remove Min Element

- n = 0 => fail.
- n = 1 => heap becomes empty.
- n = 2 => only one node, take out left end point.
- n > 2 => not as simple.

Remove Min Element Example



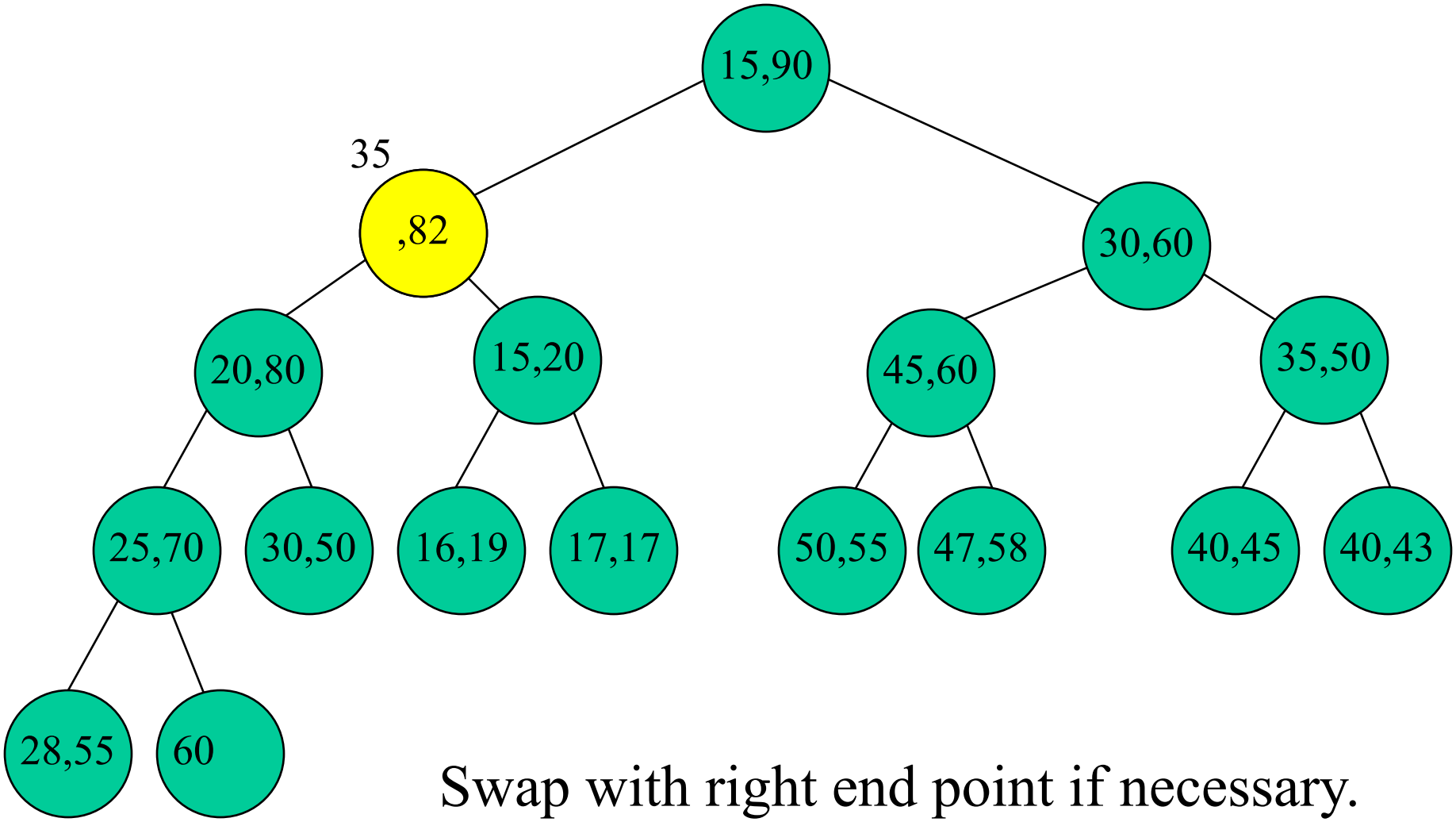
Remove left end point from root.

Remove left end point from last node.

Delete last node if now empty.

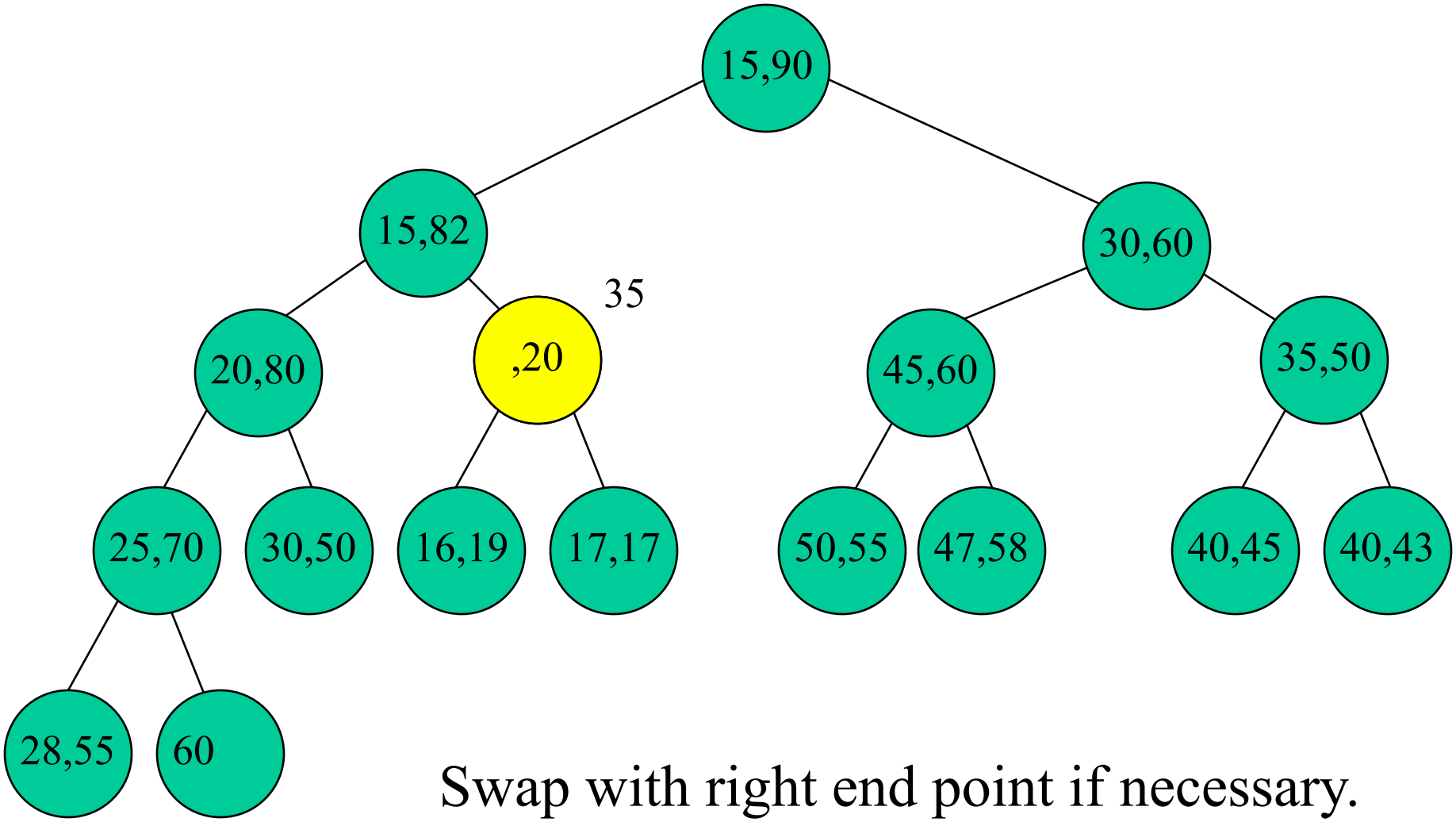
Reinsert into min heap, begin at root.

Remove Min Element Example



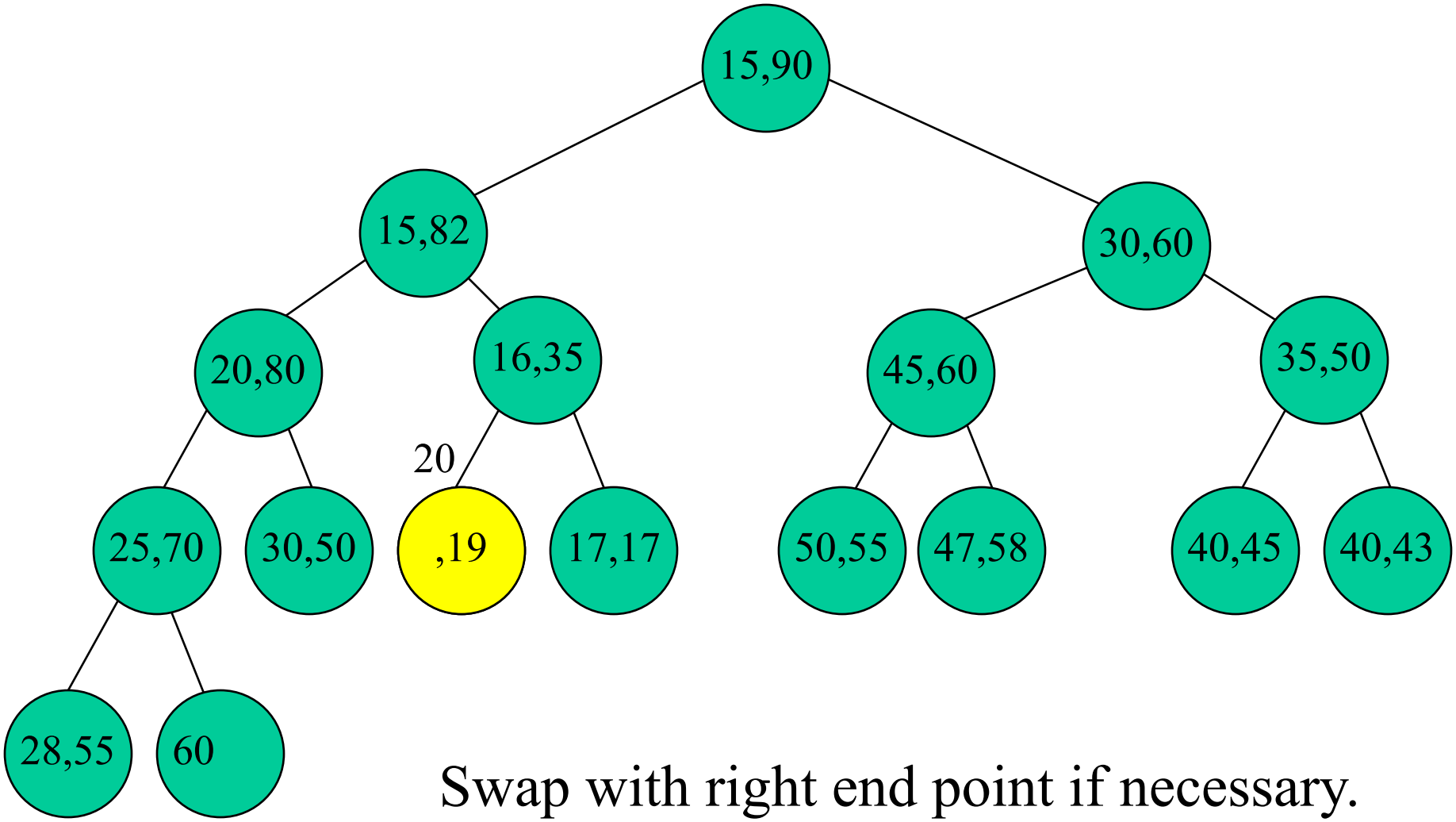
Swap with right end point if necessary.

Remove Min Element Example



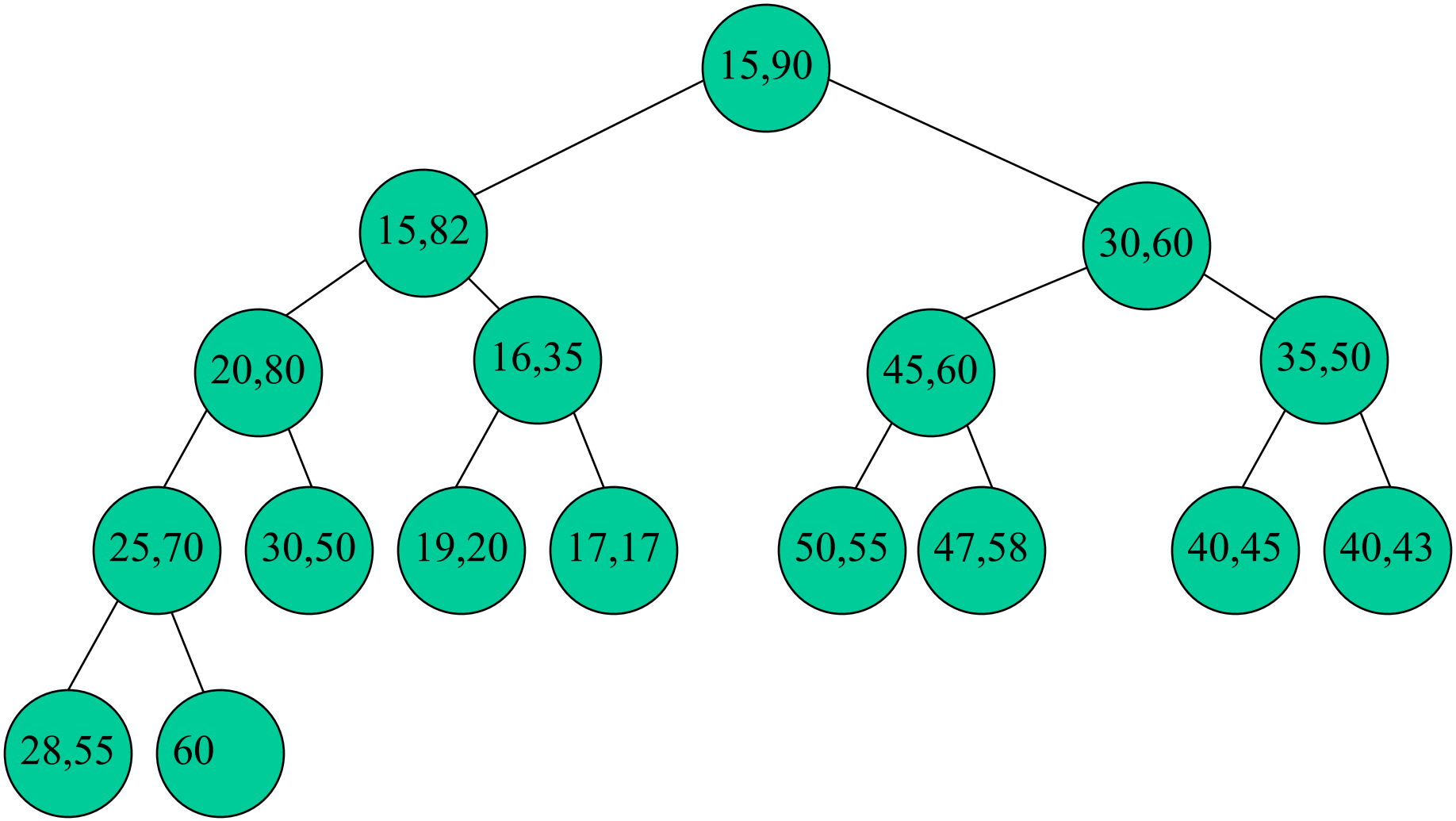
Swap with right end point if necessary.

Remove Min Element Example

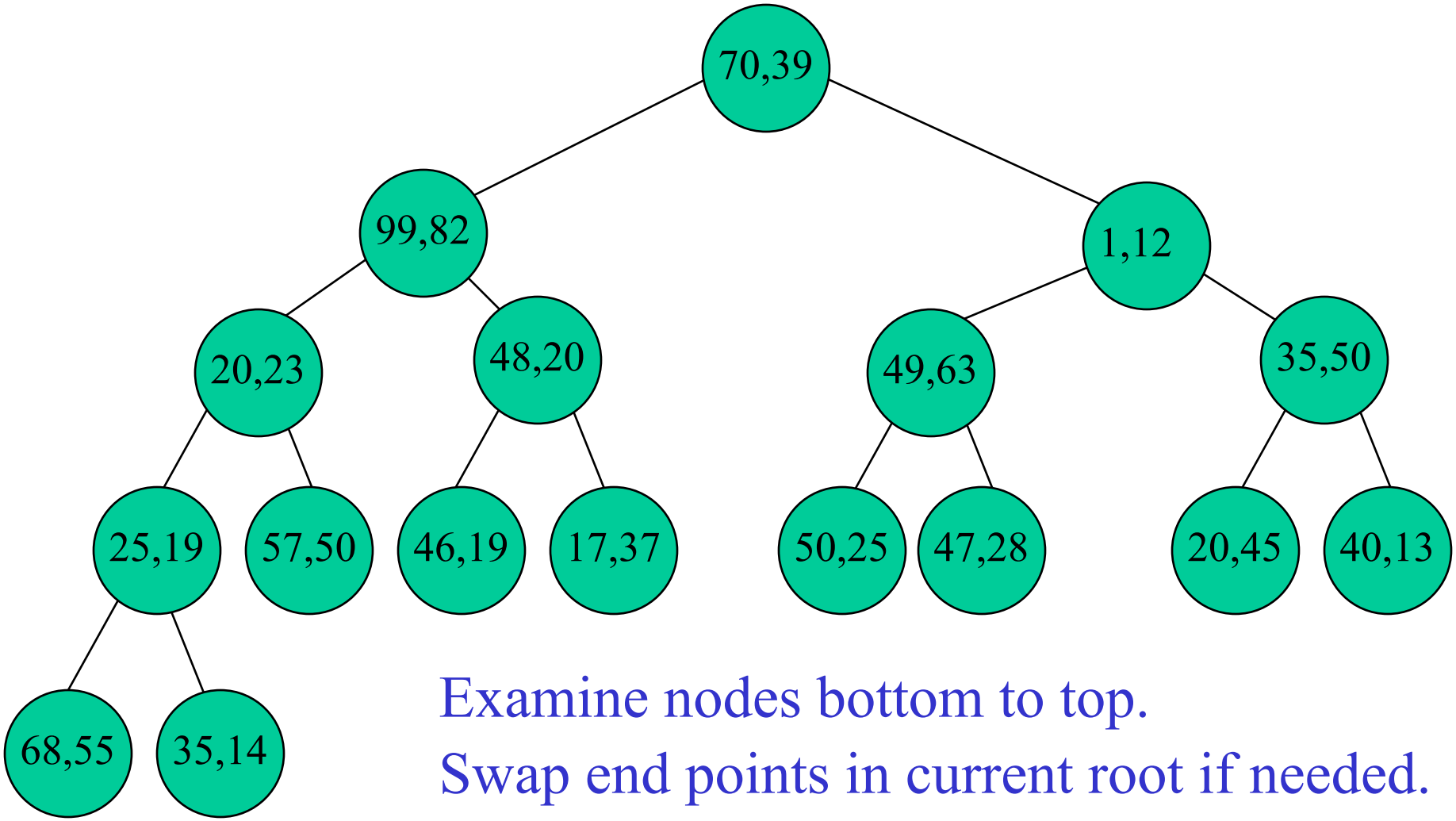


Swap with right end point if necessary.

Remove Min Element Example



Initialize



Examine nodes bottom to top.

Swap end points in current root if needed.

Reinsert left end point into min heap.

Reinsert right end point into max heap.