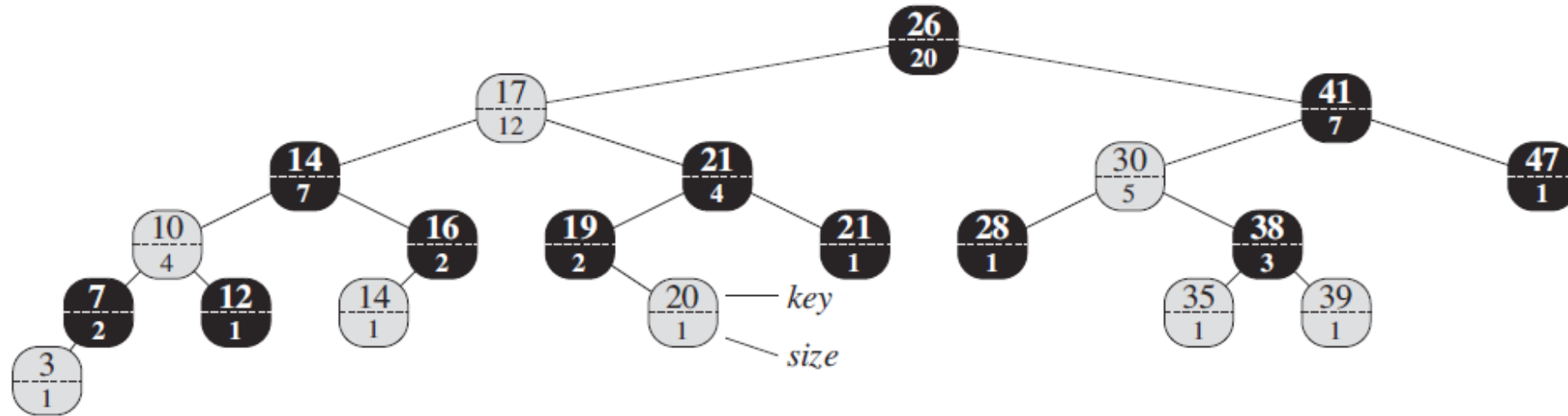


# AUGMENTING DATA STRUCTURES

335 Fall 2022 – Recitation 9

# Order Statistic Tree



- Find rank-10 and rank-17 value from the OST above
- Find ranks of values 38 and 20 from the OST above
- Discussion: What would be the effects when we change the size to the rank as the additional information?

# Remainder: OST Operations

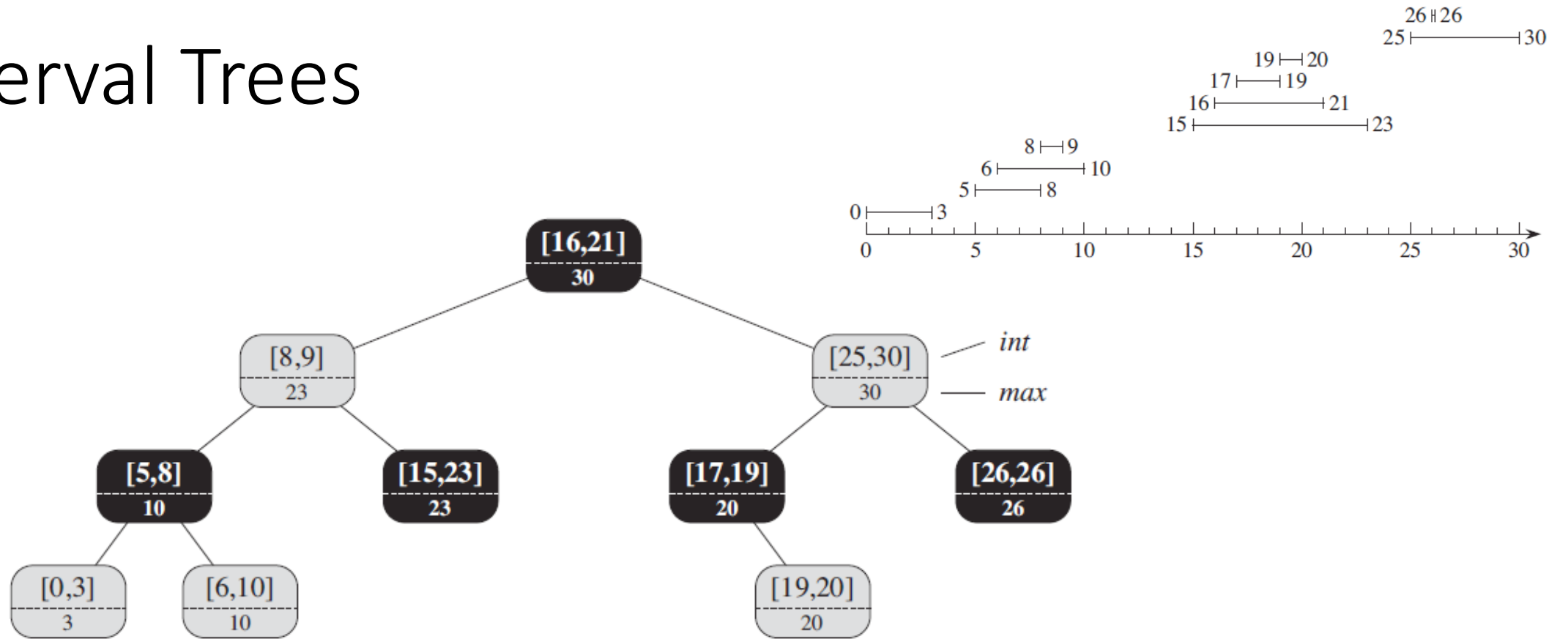
OS-SELECT( $x, i$ )

```
1   $r = x.left.size + 1$ 
2  if  $i == r$ 
3      return  $x$ 
4  elseif  $i < r$ 
5      return OS-SELECT( $x.left, i$ )
6  else return OS-SELECT( $x.right, i - r$ )
```

OS-RANK( $T, x$ )

```
1   $r = x.left.size + 1$ 
2   $y = x$ 
3  while  $y \neq T.root$ 
4      if  $y == y.p.right$ 
5           $r = r + y.p.left.size + 1$ 
6       $y = y.p$ 
7  return  $r$ 
```

# Interval Trees



- Find an interval [22, 25] and [11, 14] from the interval tree above

# Remainder: Interval Tree Search

INTERVAL-SEARCH( $T, i$ )

```
1   $x = T.root$ 
2  while  $x \neq T.nil$  and  $i$  does not overlap  $x.int$ 
3      if  $x.left \neq T.nil$  and  $x.left.max \geq i.low$ 
4           $x = x.left$ 
5      else  $x = x.right$ 
6  return  $x$ 
```