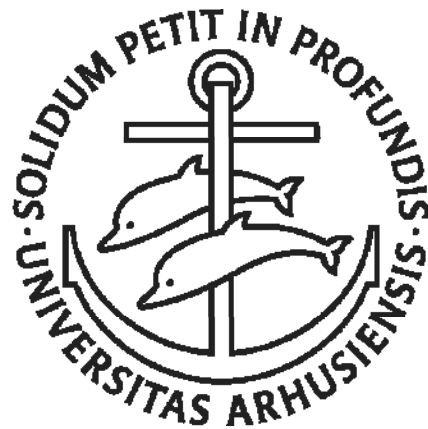


Algoritmer og Datastrukturer 1

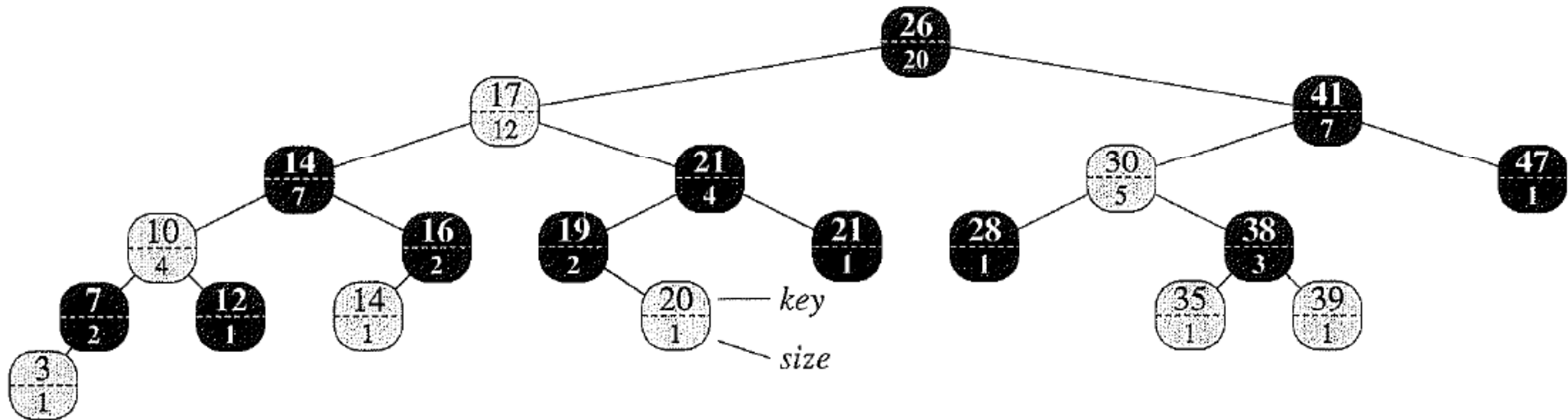
Dynamisk Rang & Interval Træer
[CLRS, kapitel 14]



Gerth Stølting Brodal

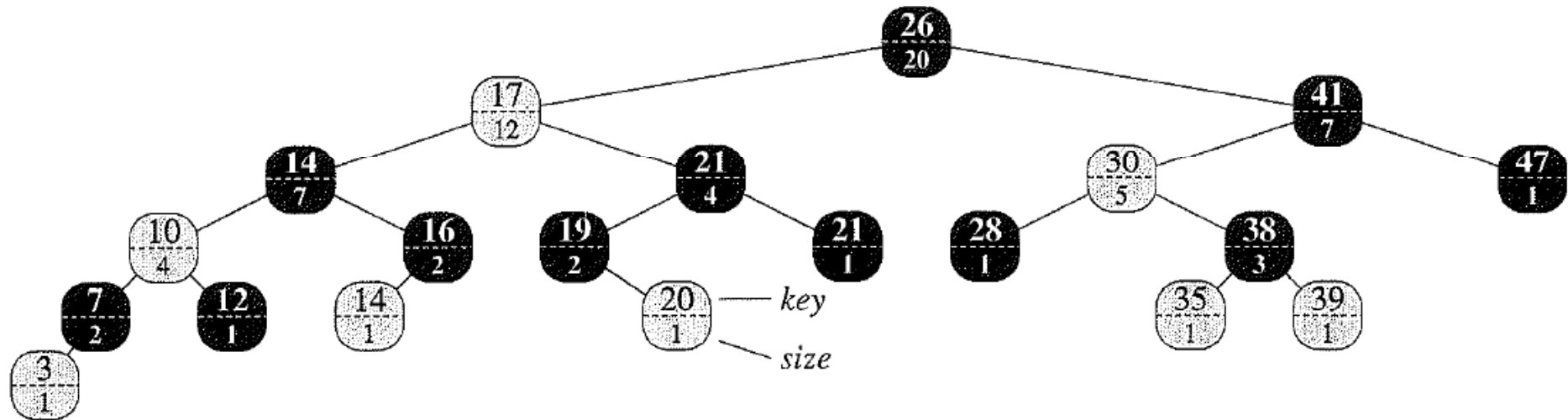
Aarhus Universitet

Dynamisk Rang



- Find det i 'te mindste, indsættelser, slettelser
- Vedligehold i rød-sort søgetræ
- Udvid hver knude med størrelse af undertræerne

Dynamisk Rang



OS-RANK(T, x)

```

1   $r \leftarrow \text{size}[\text{left}[x]] + 1$ 
2   $y \leftarrow x$ 
3  while  $y \neq \text{root}[T]$ 
4      do if  $y = \text{right}[p[y]]$ 
5          then  $r \leftarrow r + \text{size}[\text{left}[p[y]]] + 1$ 
6           $y \leftarrow p[y]$ 
7  return  $r$ 

```

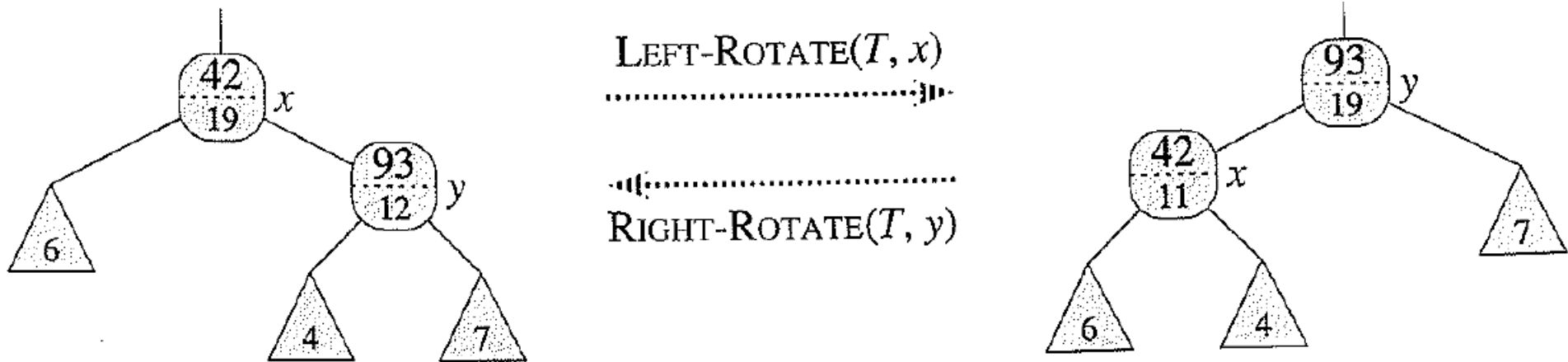
OS-SELECT(x, i)

```

1   $r \leftarrow \text{size}[\text{left}[x]] + 1$ 
2  if  $i = r$ 
3      then return  $x$ 
4  elseif  $i < r$ 
5      then return OS-SELECT( $\text{left}[x], i$ )
6  else return OS-SELECT( $\text{right}[x], i - r$ )

```

Dynamisk Rang



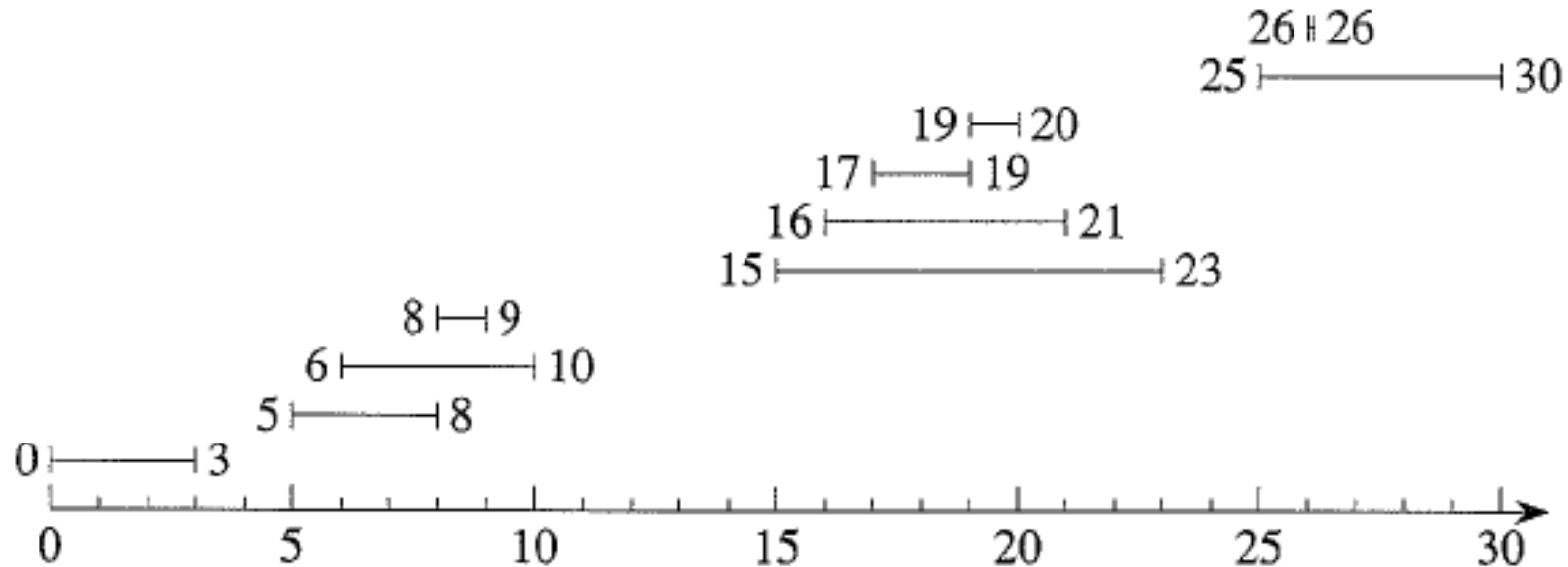
- Under rebalancing af det rød-sort træg, vedligehold information om understørrelsen af undertræerne (skal kun ske under rotationerne)

Dynamisk Rang

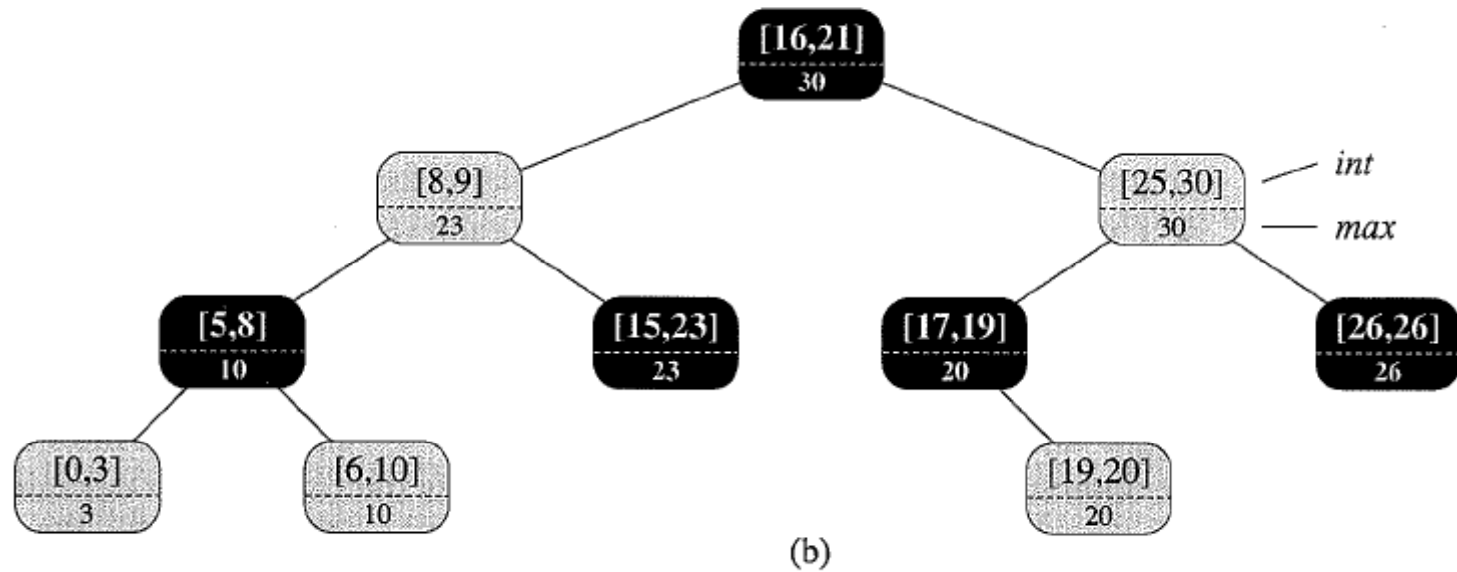
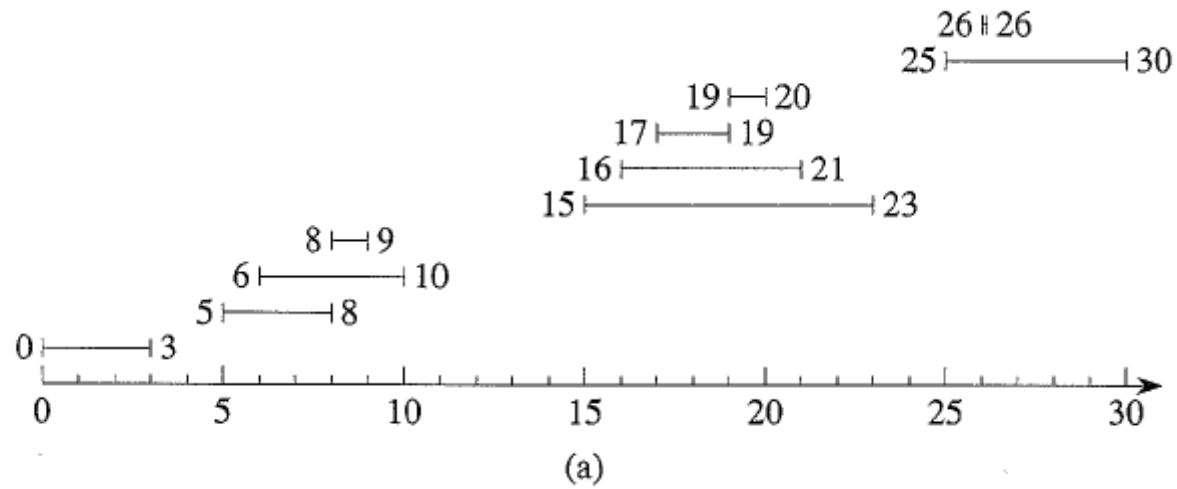
Select(S,i)	$O(\log n)$
Rank(S,x)	
Insert(S,x)	
Delete(S,x)	

Interval Træer

- Vedligehold en mængde af intervaller
- Indsæt og slet indsatte intervaller
- Søg om overlap med et givet interval



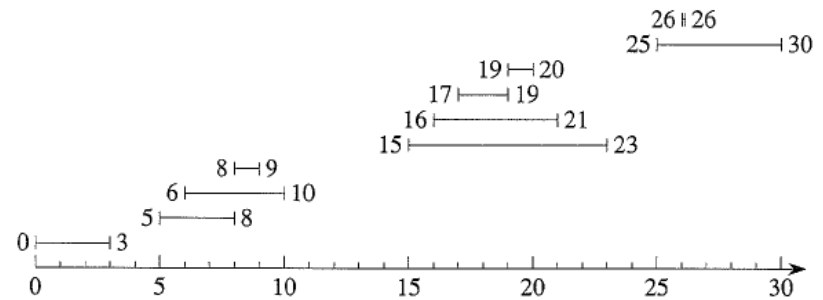
Interval Træer



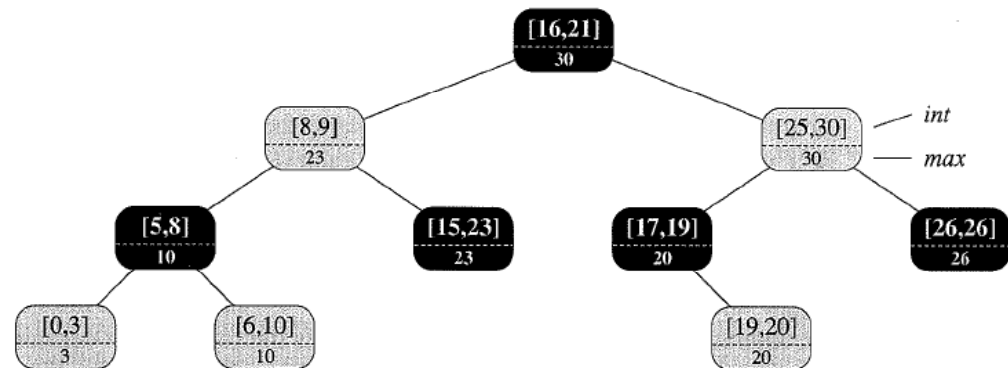
Interval Træer

INTERVAL-SEARCH(T, i)

- 1 $x \leftarrow \text{root}[T]$
- 2 **while** $x \neq \text{nil}[T]$ and i does not overlap $\text{int}[x]$
- 3 **do if** $\text{left}[x] \neq \text{nil}[T]$ and $\text{max}[\text{left}[x]] \geq \text{low}[i]$
- 4 **then** $x \leftarrow \text{left}[x]$
- 5 **else** $x \leftarrow \text{right}[x]$
- 6 **return** x



(a)



(b)

Dynamisk Rang

Search(T,i)	$O(\log n)$
Insert(T,i)	
Delete(T,i)	