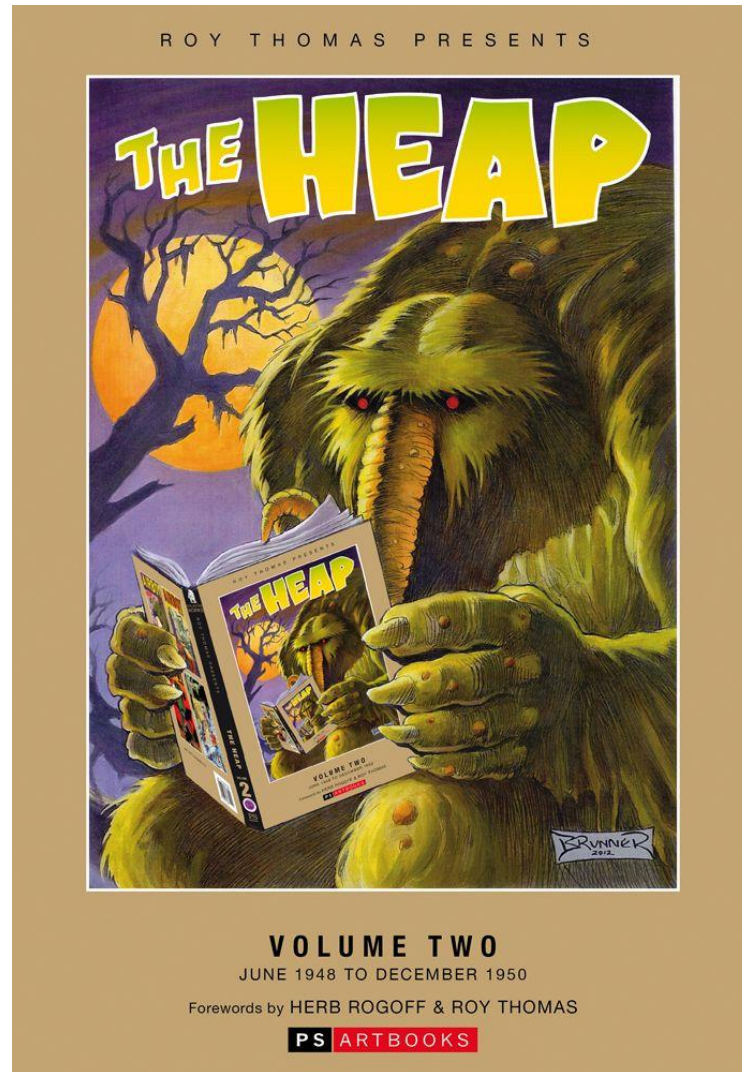


Topic 5. «Heap»



What is heap?

- Heap – a specialized tree-based data structure that satisfies the heap property: if A is a parent node of B then the key of node A is ordered with respect to the key of node B with the same ordering applying across the heap.

Max & Min heaps

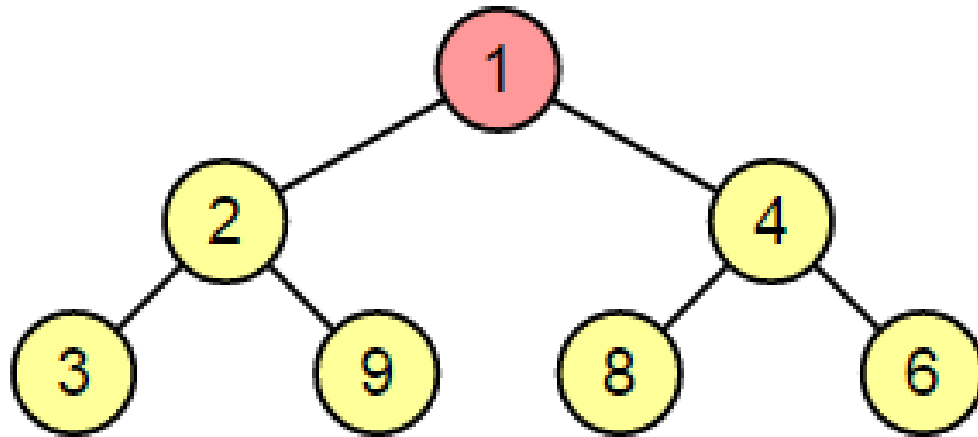
- **Max heap**

Keys of parent nodes are always greater than or equal to those of the children and the highest key is in the root node.

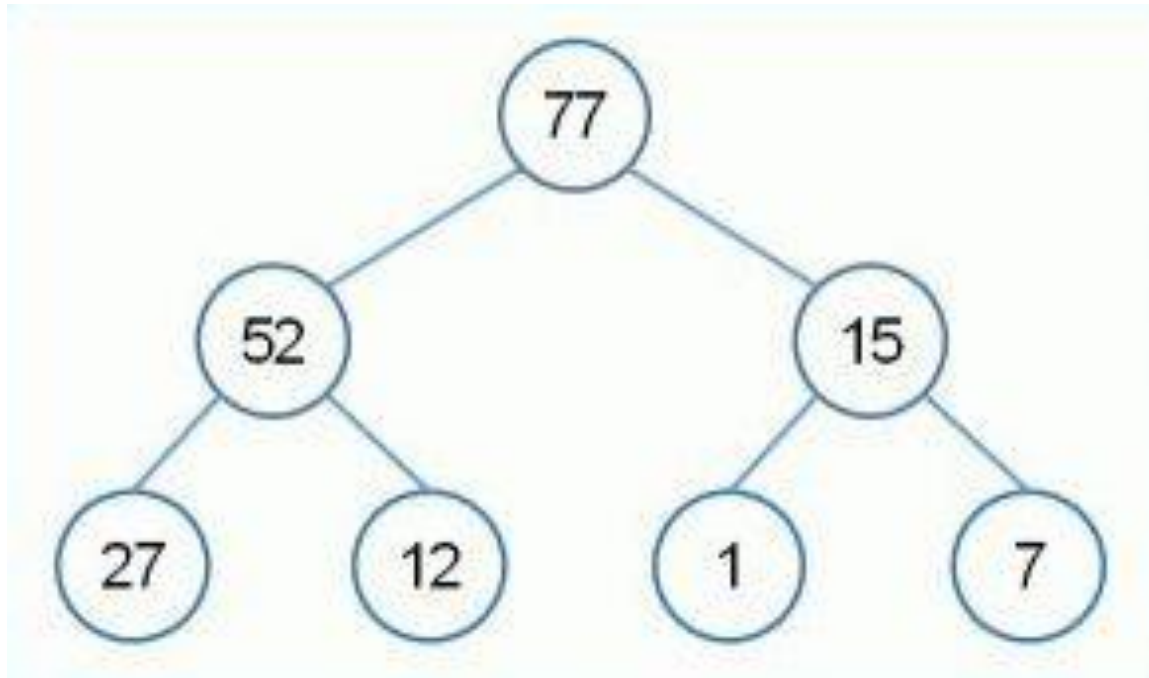
- **Min heap**

Keys of parent nodes are less than or equal to those of the children and the lowest key is in the root node.

Min heap example



Max heap example



STL priority_queue

- Container adaptors, specifically designed such that its first element is always the greatest of the elements it contains, according to some strict weak ordering criterion.
- Heap is used for implementation of STL priority_queue.

Declaration

```
#include <queue>

priority_queue < int > maxq;
priority_queue < double, vector<double>, greater<double> > minq;
```

How to access elements?

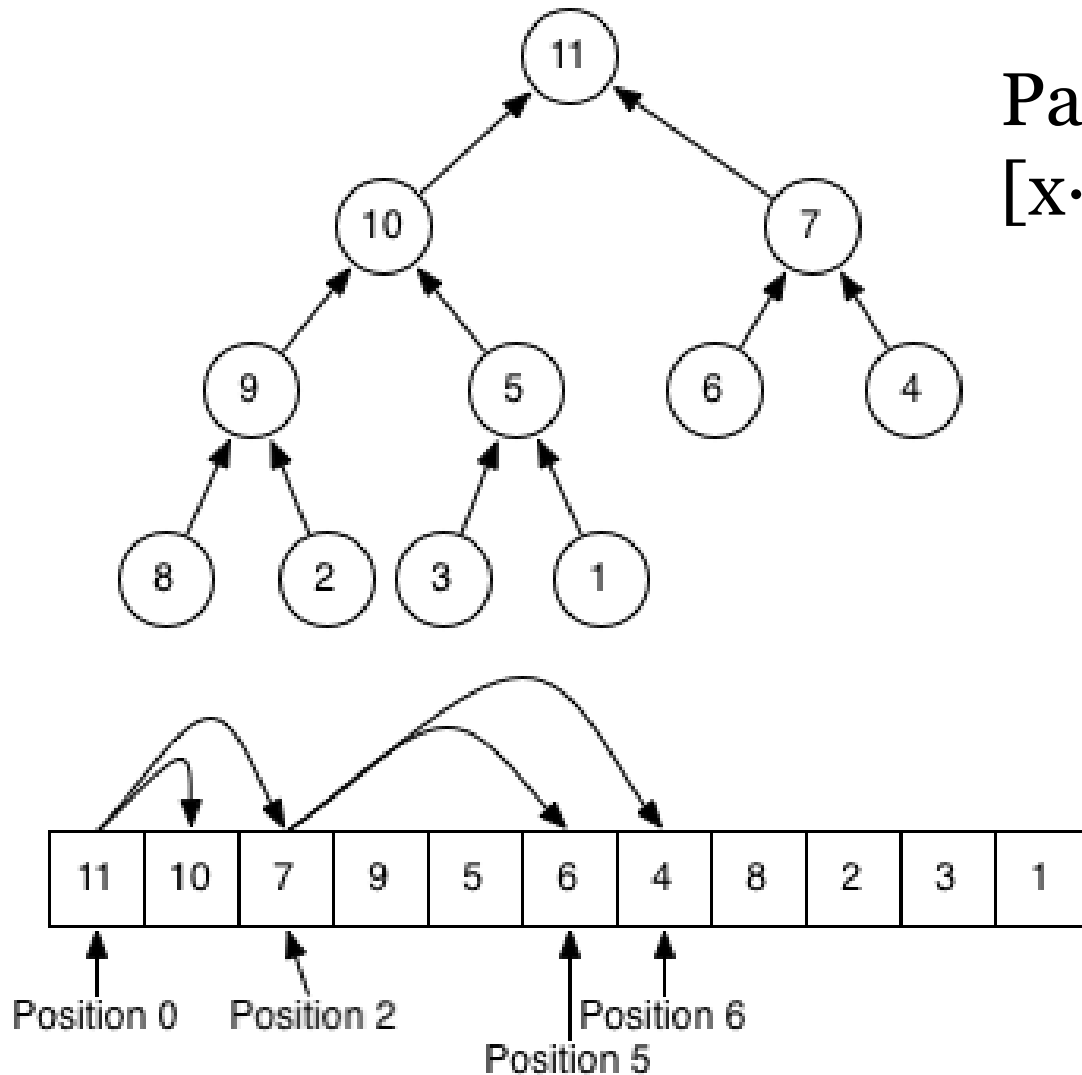


Methods

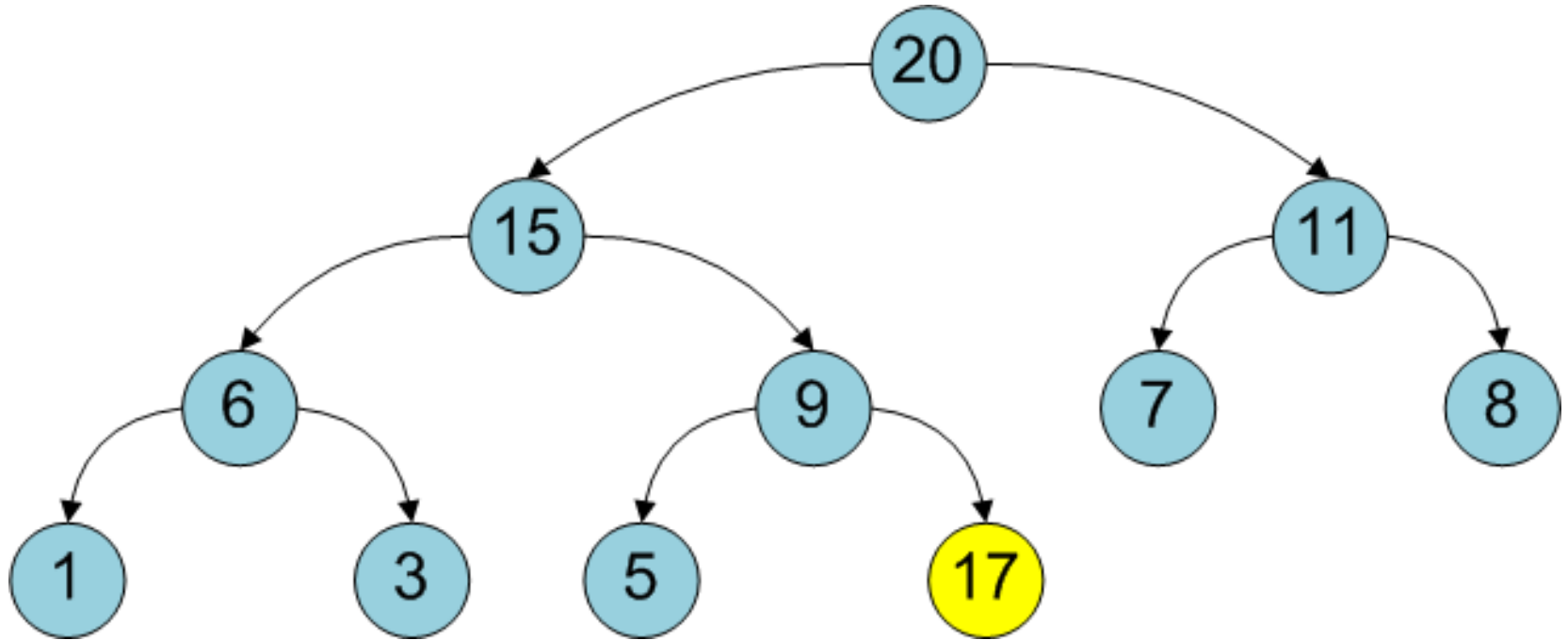
- `size()` – the number of elements in queue;
- `top()` – the top element;
- `pop()` – remove the top element;
- `push(x)` – add element `x` to the queue;
- `empty()` – **true** if the queue is empty, **false** – otherwise.

How to implement own heap?

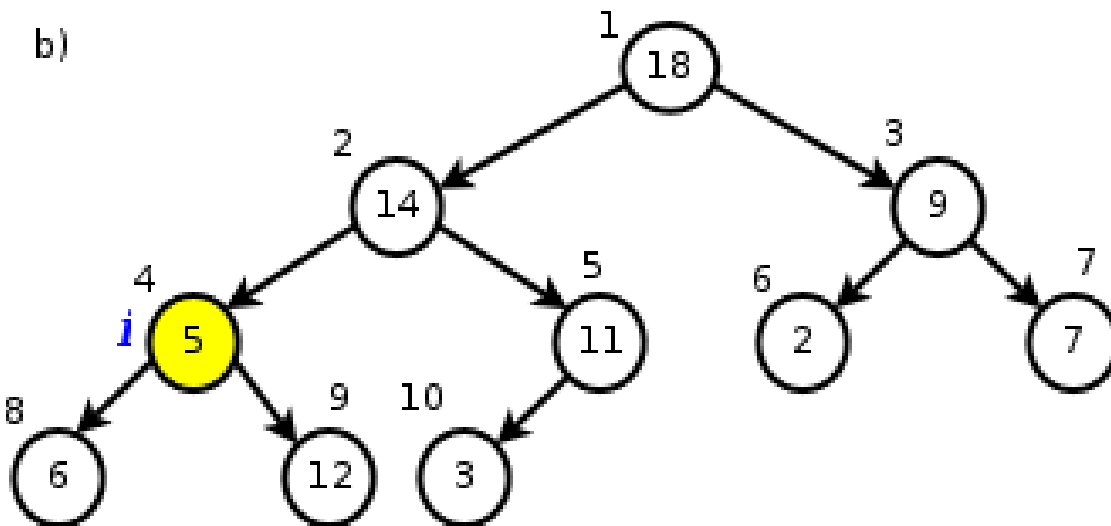
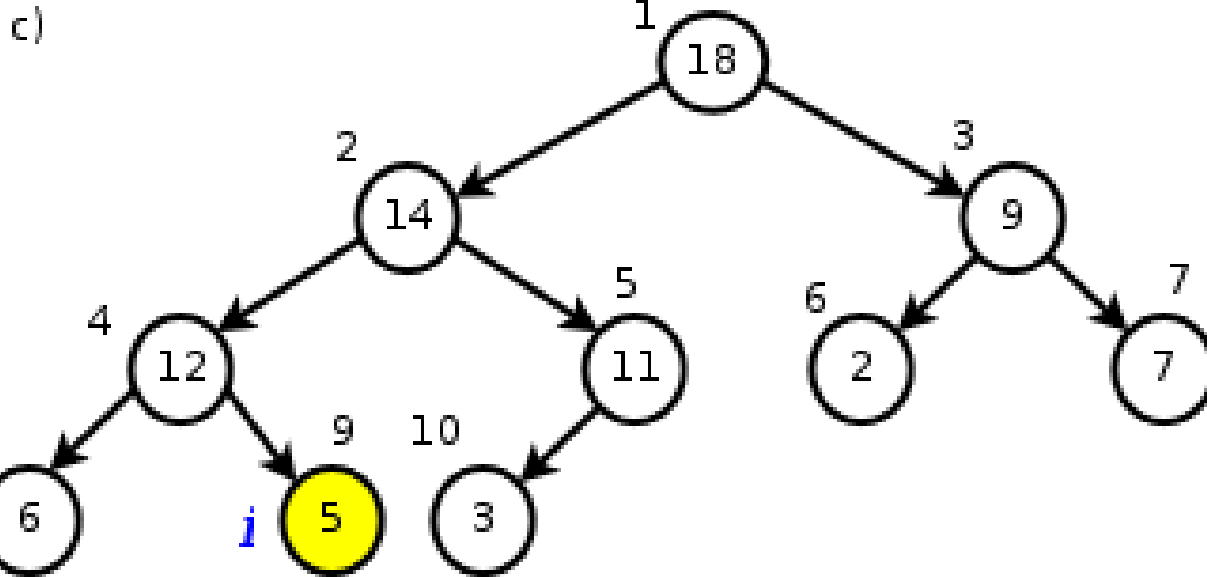
Parent $[x]$ has children $[x \cdot 2 + 1]$ and $[x \cdot 2 + 2]$



How to add elements to heap?



How to remove elements from heap?



Questions?

