

- The ADT Priority Queue is a container in which each element has an associated *priority* (of type *TPriority*).
- In a Priority Queue access to the elements is restricted: we can access only the element with the highest priority.
- Because of this restricted access, we say that the Priority Queue works based on a **HPF - Highest Priority First** policy.
- The domain of the ADT Priority Queue:
 $\mathcal{PQ} = \{pq \mid pq \text{ is a priority queue with elements } (e, p), e \in TElem, p \in TPriority\}$
- **init (pq, R)**
 - **descr:** creates a new empty priority queue
 - **pre:** R is a relation over the priorities,
 $R : TPriority \times TPriority$
 - **post:** $pq \in \mathcal{PQ}$, pq is an empty priority queue
- **destroy(pq)**
 - **descr:** destroys a priority queue
 - **pre:** $pq \in \mathcal{PQ}$
 - **post:** pq was destroyed
- **push(pq, e, p)**
 - **descr:** pushes (adds) a new element to the priority queue
 - **pre:** $pq \in \mathcal{PQ}, e \in TElem, p \in TPriority$
 - **post:** $pq' \in \mathcal{PQ}, pq' = pq \oplus (e, p)$

- **pop** (pq)
 - **descr:** pops (removes) from the priority queue the element with the highest priority. It returns both the element and its priority
 - **pre:** $pq \in \mathcal{PQ}$, pq is not empty
 - **post:** $pop \leftarrow (e, p)$, $e \in TElem$, $p \in TPriority$, e is the element with the highest priority from pq , p is its priority.
 $pq' \in \mathcal{PQ}$, $pq' = pq \ominus (e, p)$
 - **throws:** an exception if the priority queue is empty.
- **top** (pq)
 - **descr:** returns from the priority queue the element with the highest priority and its priority. It does not modify the priority queue.
 - **pre:** $pq \in \mathcal{PQ}$, pq is not empty
 - **post:** $top \leftarrow (e, p)$, $e \in TElem$, $p \in TPriority$, e is the element with the highest priority from pq , p is its priority.
 - **throws:** an exception if the priority queue is empty.
- **isEmpty**(pq)
 - **Description:** checks if the priority queue is empty (it has no elements)
 - **Pre:** $pq \in \mathcal{PQ}$
 - **Post:**
$$isEmpty \leftarrow \begin{cases} \text{true, if } pq \text{ has no elements} \\ \text{false, otherwise} \end{cases}$$
- **Note:** priority queues cannot be iterated, so they don't have an *iterator* operation!