Priority Queues

CS 430 Spring 2025

Operations Supported (Max-Heap)

1. Find-Max(A)

2. Heap-Extract-Max(A)

3. Insert(A,x)

4. Increase-Key(A,x)

5. Delete(A,x) - can be done by Increase-Key(A,∞) followed by Heap-Extract-Max(A)

Heap-Extract-Max

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Heap-Extract-Max(A)
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    if $heap\_size < 1$

        then return 'heap underflow'

    $max \leftarrow A[1]$

    $A[1] \leftarrow A[heap\_size]$

    $heap\_size \leftarrow heap\_size - 1$

    Heapify $(A, 1)$

    return max

Increase-Key(A,x)

Heap-Increase-Key(A, i, key)

    if $key < A[i]$

        then error 'new key is smaller than current key'

    $A[i] \leftarrow key$

    while $i > 1$ and $A[Parent(i)] < A[i]$ do

        exchange $A[i] \leftrightarrow A[Parent(i)]$

        $i \leftarrow Parent(i)$ (same as $i \leftarrow \lfloor i/2 \rfloor$)

Insert(A,x)

$\texttt{Insert}(A, x)$

$\quad heap\_size \leftarrow heap\_size + 1$

$\quad A[heap\_size] \leftarrow -\infty$

$\quad \texttt{Increase-Key}(A, heap\_size, key(x))$