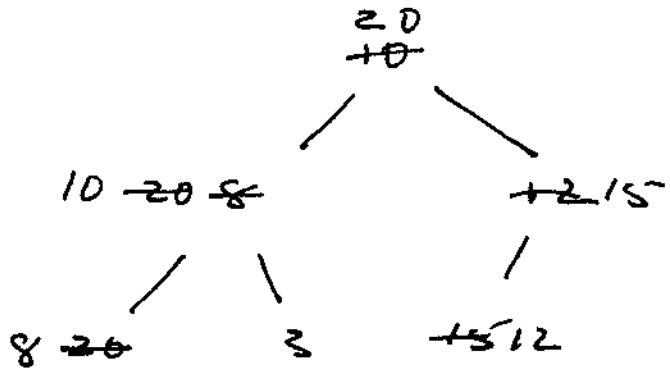
CSE 101 6-2-20

Part: ext. 1 day

Ex. HeapSort

A = | 10 | 8 | 12 | 20 | 3 | 15 |

first do BuildHeap(A)

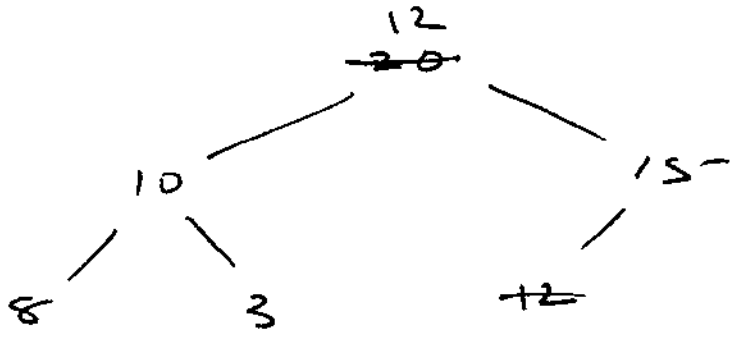


after BuildHeap :

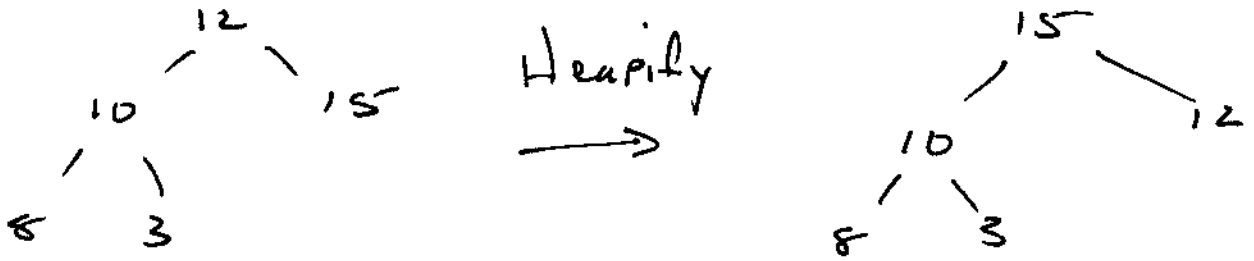
A | 20 | 10 | 15 | 8 | 3 | 12 |

heapSize

~~20~~ 12 | 10 | 15 | 8 | 3 | ~~12~~ 20

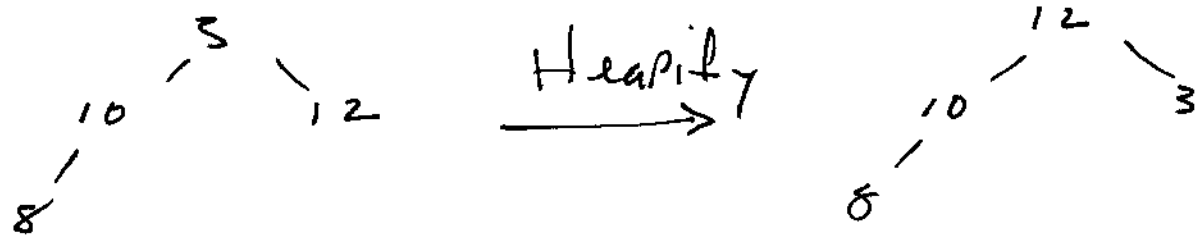


12 | 10 | 15 | 8 | 3 | 20



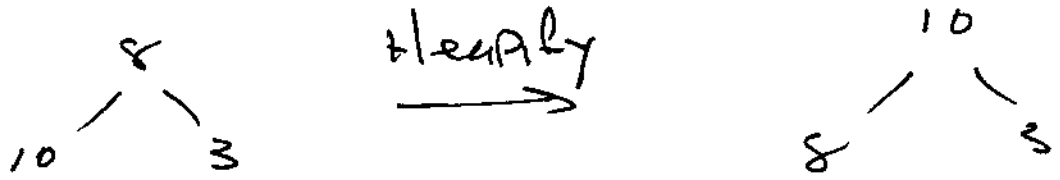
15 | 10 | 12 | 8 | 3 | 20

3 | 10 | 12 | 8 | 15 | 20



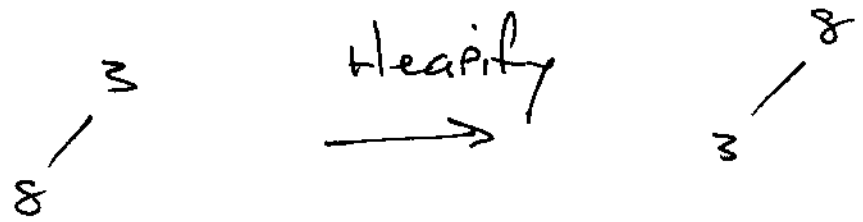
12 10 3 8 | 15 20

8 10 3 | 12 15 20



10 8 3 | 12 15 20

3 8 | 10 12 15 20



8 3 | 10 12 15 20

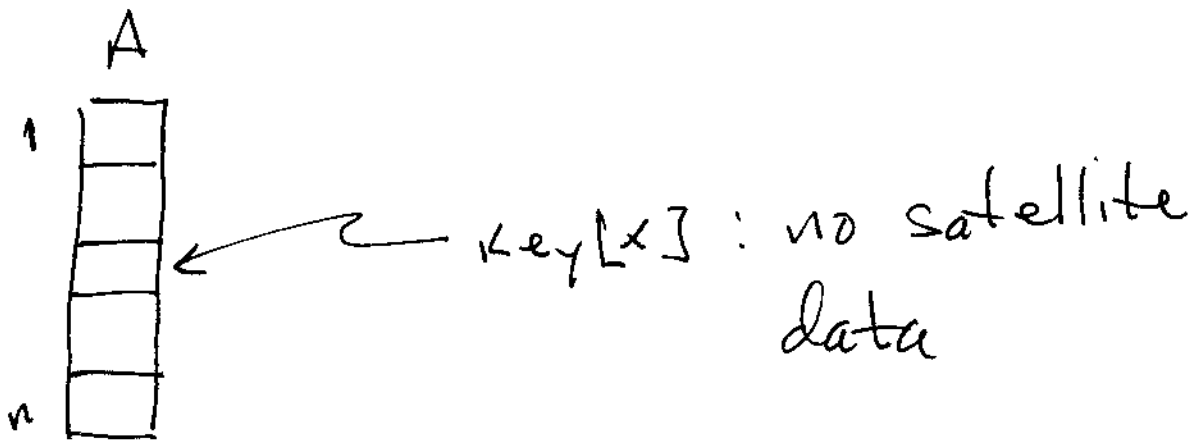
3 | 8 10 12 15 20 stop.

Priority Queue Operations

- Insert
- Maximum
- ExtractMax
- IncreaseKey

  also
- DeleteMax

Heap implementation



See pseudo code

	runtime
HeapMaximum( )	$\Theta(1)$
HeapDeleteMax( )	$\Theta(\log n)$
HeapExtractMax( )	$\Theta(\log n)$
HeapIncreaseKey( )	$\Theta(\log n)$
HeapInsert( )	$\Theta(\log n)$

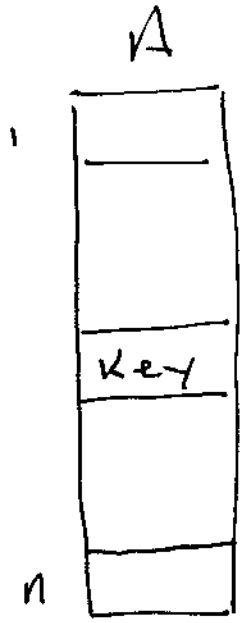
Exercise

Write Min(), DeleteMin(), ExtractMin() & DecreaseKey() & Insert for a min-PQ based on a min-heap.

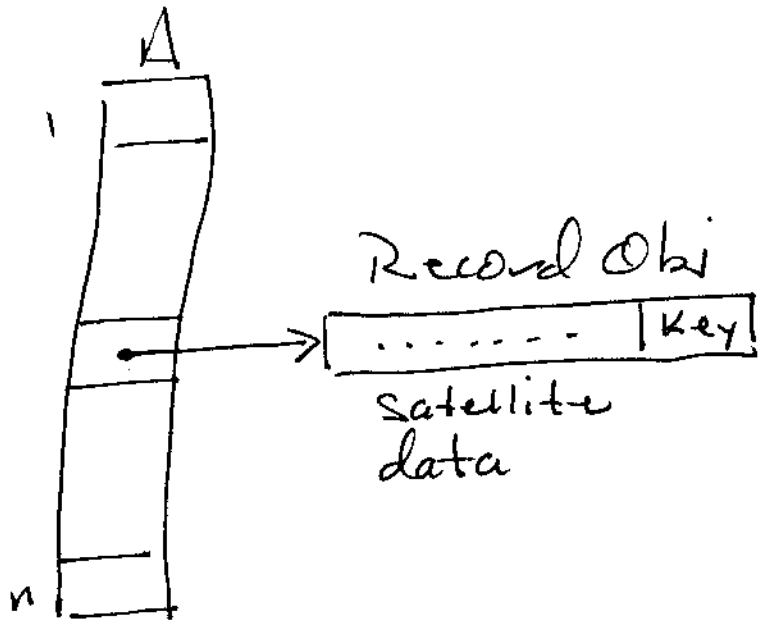
Exercise

re-write all P.Q. algorithms in the general Picture

our Picture



general Picture



- Looking back at Dijkstra's with P.Q. implemented as min-Heap: $(n = |V|, m = |E|)$.

$$\text{Runtime} = \underbrace{\Theta(n \log n)}_{\text{total cost of calls to ExtractMin()}} + \underbrace{\Theta(m \log n)}_{\text{total cost of all calls to Relax()}}$$

$$= \Theta((n+m) \log n)$$

How to implement the tests

- if $F + \{e\}$ is acyclic
- if $F - \{e\}$ is connected

in Kruskal & DualKruskal ?

Chapter 21 Disjoint Sets

A disjoint set ADT maintains a collection of dynamic sets

$$\{S_1, S_2, \ldots, S_n\}$$

which are pairwise disjoint, i.e.

$$S_i \cap S_j = \emptyset \quad (i \neq j)$$

Each set in the collection is identified by a distinguished element called its representative

Ex

$$\{\{a, b, c\}, \{d, e\}, \{f\}, \{g, h\}\}$$

most of the time, we don't care which element is the representative

Notation S_x stands for the unique member of collection containing x (which need not be the representative.

$$\{S_a, S_d, S_f, S_g\}$$

OPS: next time.