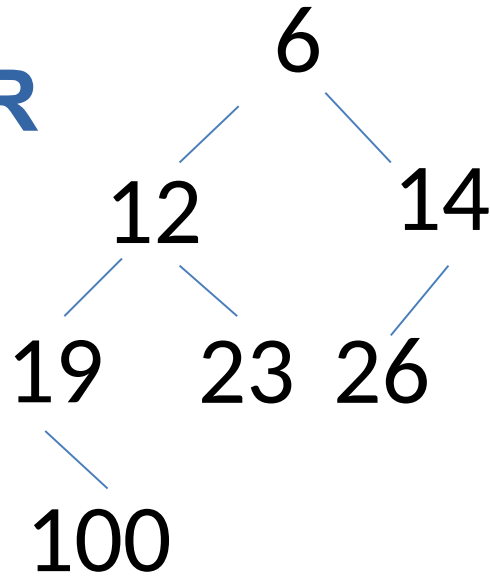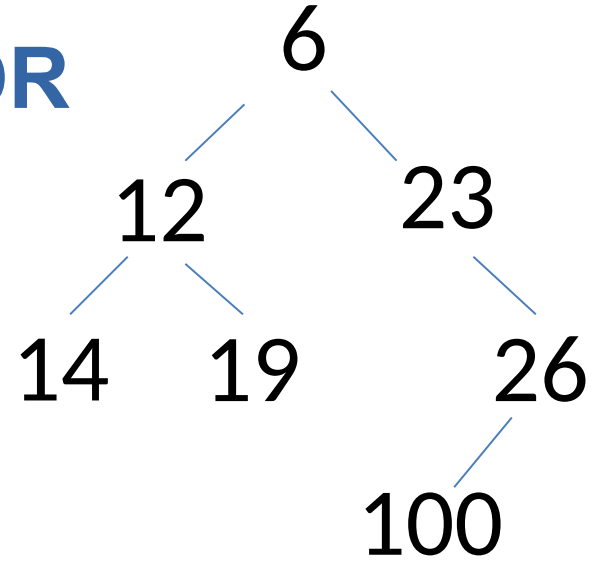OR ...

Set of all valid solutions

A heap is in the set of all valid solutions if and only if...

- It is a heap

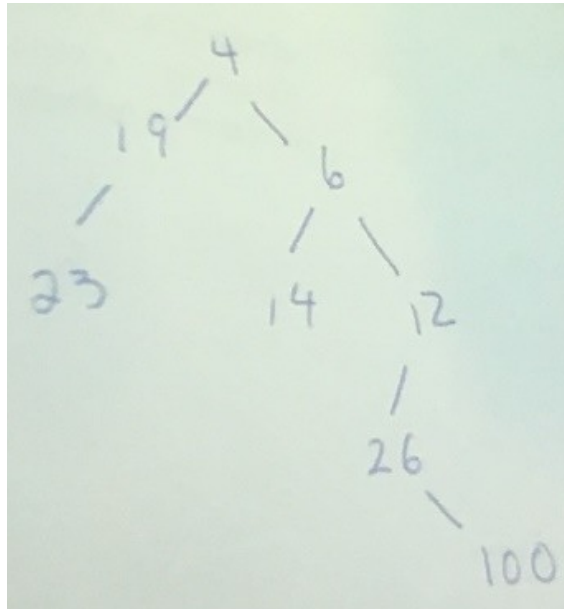- The result contains all the elements from the original heap (the same number of occurrences)

- The new element has been added (`addEltTester`) or the smallest element removed (`remMinEltTester`)

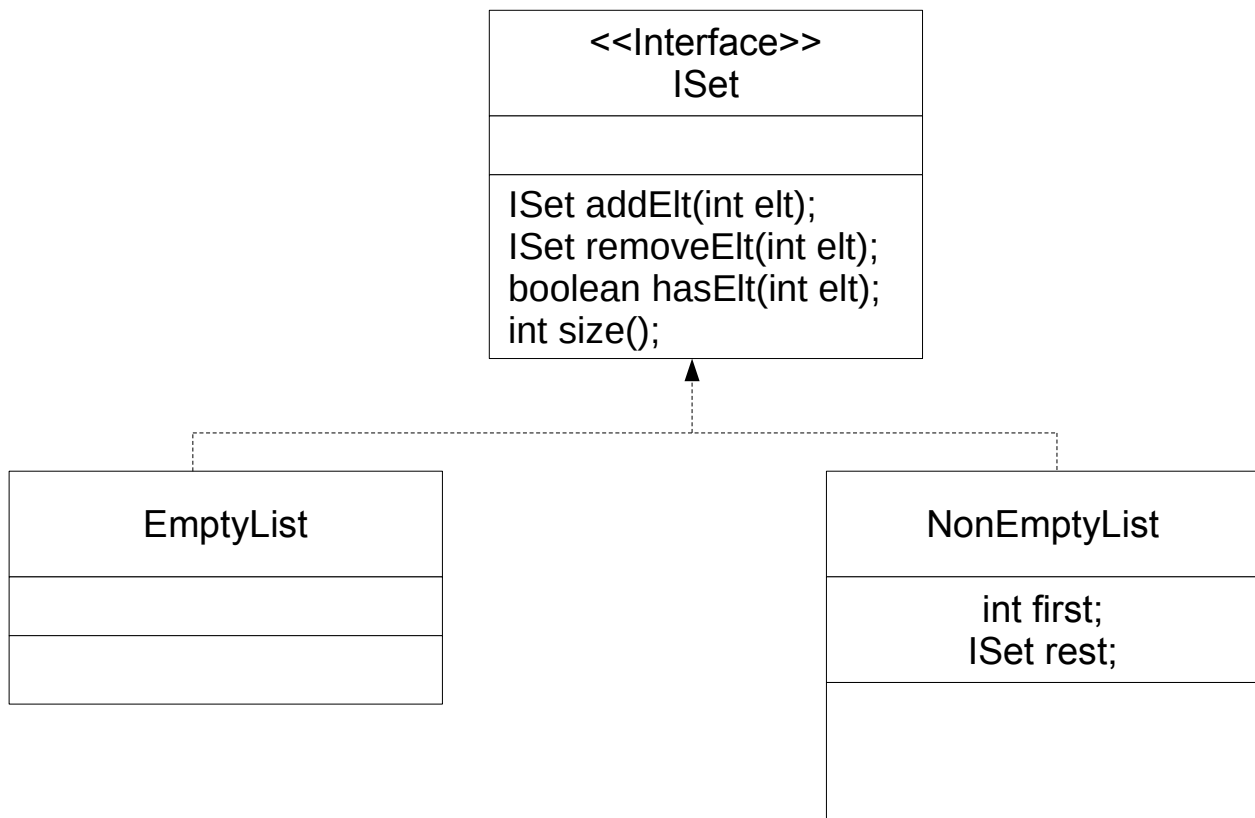- No elements are in the result that weren't in the original

This is Homework 4

Heaps

A heap is a binary tree (NOT a BST) such that the smallest item is the root of the tree and the left and right subtrees are heaps.

```
┌─────────────────────────────┐
│      <<Interface>>          │
│         ISet                │
├─────────────────────────────┤
│                             │
├─────────────────────────────┤
│ ISet addElt(int elt);       │
│ ISet removeElt(int elt);    │
│ boolean hasElt(int elt);    │
│ int size();                 │
└─────────────────────────────┘
```

```
┌─────────────────────────────┐        ┌─────────────────────────────┐
│         EmptyList           │        │       NonEmptyList          │
├─────────────────────────────┤        ├─────────────────────────────┤
│                             │        │        int first;           │
├─────────────────────────────┤        │        ISet rest;           │
│                             │        ├─────────────────────────────┤
└─────────────────────────────┘        │                             │
                                       │                             │
                                       └─────────────────────────────┘
```

```
┌─────────────────────────────┐
│      <<Interface>>          │
│        IBinTree             │
├─────────────────────────────┤
│                             │
├─────────────────────────────┤
│ boolean hasElt(int e)       │
│ int size()                  │
│ int height()                │
└─────────────────────────────┘
              ▲
      ┌───────┴───────┐
      ┊               ┊
┌──────────────┐  ┌──────────────────┐
│    MtBT      │  │     DataBT        │
├──────────────┤  ├──────────────────┤
│              │  │   int data;       │
├──────────────┤  │   IBinTree left;  │
│              │  │   IBinTree right; │
└──────────────┘  ├──────────────────┤
                  │                   │
                  └──────────────────┘
```
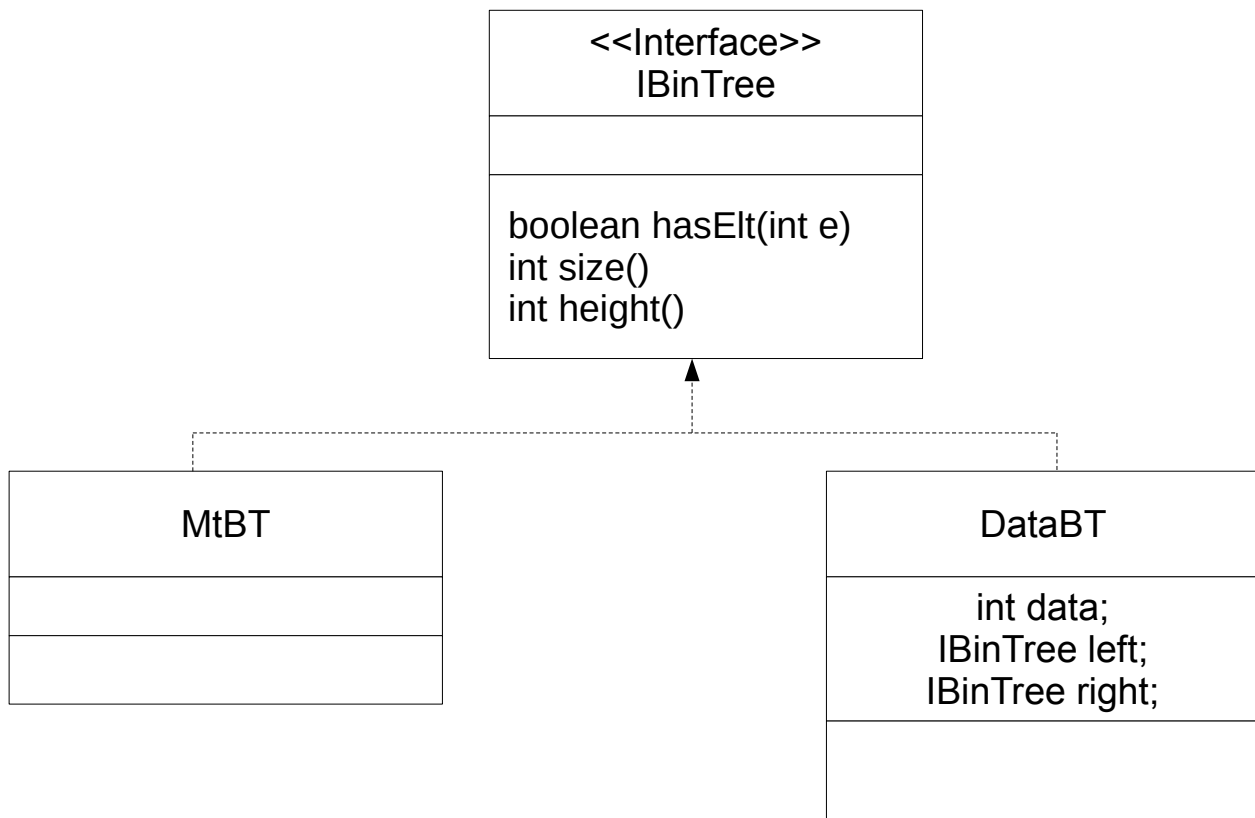
Warnings

- Avoid type-checking, i.e.
  - `instanceof`
  - **casting**
  - `getClass()`
  - `static`
- **Do not call** `addElt()` **in** `addEltTester()` **or** `remMinElt()` **in** `remMinEltTester()`