Implementation of a binary tree with an array

Variables

tree: array of positions; each position contains an element and an index
size: integer
invariant: *tree*$[i]$ contains (e, i) if and only if the binary tree has a node with level numbering i and element e; *size* is the size of the binary tree.

Initialization

```
size ← 0
```

Algorithms

```
size():
  output: size of binary tree
return size
```

```
isEmpty():
  output: binary tree is empty?
return (size = 0)
```

```
root():
  output: root of the binary tree
return tree[1]
```

```
parent(node):
  precondition: node is not the root of the tree
  input: node of the binary tree
  output: parent of node
index ← index of node div 2
return tree[index]
```

```
leftChild(node):
  precondition: node is not a leaf
  input: node of the binary tree
  output: left child of node
index ← $2 \cdot$ index of node
return tree[index]
```

```
rightChild(node):
  precondition: node is not a leaf
  input: node of the binary tree
  output: right child of node
index ← $2 \cdot$ index of $node + 1$
return tree[index]
```