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 $\leftarrow 0$

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 $\leftarrow$ 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 $\leftarrow 2 \cdot$ 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 $\leftarrow 2 \cdot$ index of $node + 1$
return *tree*[*index*]