

Implementation of a vector with an array

Variables

sequence: array of elements

size: integer

invariant: $sequence[0], \dots, sequence[size - 1]$ are the elements of the vector

Initialization

$size \leftarrow 0$

Algorithms

size():

output: size of vector

return *size*

isEmpty():

output: vector is empty?

return ($size = 0$)

elemAtRank(*rank*):

precondition: *rank* is valid¹

input: rank of element to be returned

output: element at *rank*

return $sequence[rank]$

replaceAtRank(*rank*, *element*):

precondition: *rank* is valid

postcondition: element at *rank* has been replaced by *element*

input: rank of element to be replaced and replacement element

output: replaced element

$temp \leftarrow sequence[rank]$

$sequence[rank] \leftarrow element$

return *temp*

insertAtRank(*rank*, *element*):

precondition: *rank* is valid or $rank = size$, and *sequence* is not full

postcondition: *element* has been inserted at *rank*

input: element to be inserted and rank at which element has to be inserted

move $sequence[rank], \dots, sequence[size - 1]$ one position to the right

$sequence[rank] \leftarrow element$

$size \leftarrow size + 1$

Ad (1):

for $i = size - 1, \dots, rank$ **do**

loop-invariant: $\forall j : i < j < size : sequence[j]$ has been moved one position to the right

$sequence[i + 1] \leftarrow sequence[i]$

removeAtRank(*rank*):

precondition: *rank* is valid

postcondition: element at *rank* has been removed

input: rank of the element to be removed

output: element at *rank*

$temp \leftarrow sequence[rank]$

¹ *rank* is invalid if $rank < 0 \vee rank \geq size$.

move $sequence[rank + 1], \dots, sequence[size - 1]$ one position to the left (2)
 $size \leftarrow size - 1$
return $temp$

Ad (2):

for $i = rank + 1, \dots, size - 1$ **do**
 loop-invariant: $\forall j : rank < j < i : sequence[j]$ has been moved one position to the left
 $sequence[i - 1] \leftarrow sequence[i]$