

Task1: We store the title, the author, and the publishing year about N books. The books are ordered by publishing years. List all books published before 1990.

1st idea: multiple item selection. However we know that the books are ordered by publishing years -> we can find the first book published in 1990, and copy all books published (and listed) before it.

Pattern: search + copy

Specification

Input: $n \in \mathbb{N}$, $Tbook = (title \times author \times pyear)$, $title, author \in T, pyear \in \mathbb{N}$

$Books[1..n] \in Tbook^n$,

Output: $cnt \in \mathbb{N}$, $OB[1..cnt] \in \mathbb{N}^{cnt}$,

Precondition: $n > 1$, $\forall i (1 \leq i < n) : Books[i].pyear \leq Books[i+1].pyear$

Postcondition:

$$cnt = \sum_{i=1}^{n-1} 1 \text{ and } \forall i (1 \leq i < cnt) : Books[OB[i]].pyear < 1990$$

2nd version of postcondition: $exists = \exists i (1 \leq i \leq n) : Books[i].pyear = 1990$ and $(exists$ and $1 \leq cnt < n$ and $Books[cnt+1].pyear = 1990$ or $cnt = 1)$ and $\forall i (1 \leq i \leq cnt) : Books[i].pyear < 1990)$ and $OB[i] = i$

A attribute function : $Books[i].pyear = 1990$ (the first book published in 1990)

Algorithm

1st version: multiple item selection

$cnt := 0$	
$i = 1..length(X)$	
$A(X[i])$	
T	F
$cnt := cnt + 1$	-
$Y[cnt] := i$	

$cnt := 0$	
$i = 1..n$	
$Books[i].pyear < 1990$	
T	F
$cnt := cnt + 1$	-
$OB[cnt] := i$	

2nd version: search and copy separately

$i := 1$	
$i \leq length(X)$ and not $A(X[i])$	
$i := i + 1$	
$exists := (i \leq length(X))$	
$exists$	
T	F
$ind := i$	-
$val := X[i]$	

$i = 1..length(X)$	
$Y[i] := f(X[i])$	

$i := 1$	
$i \leq n$ and $Books[i].pyear < 1990$	
$i := i + 1$	
$exists := (i \leq n)$	
$exists$	
T	F
$cnt := i - 1$	-
$j = 1..cnt$	
$OB[j] := j$	

3rd version: combined search and copy

<code>cnt:=0</code>
<code>i:=1</code>
<code>i≤length(X) and not A(X[i])</code>
<code>Y[i]:=X[i]</code>
<code>i:=i+1</code>
<code>cnt:=i-1</code>

<code>cnt:=0</code>
<code>i:=1</code>
<code>i≤n and Books[i].pyear<1990</code>
<code>OB[i]:=i</code>
<code>i:=i+1</code>
<code>cnt:=i-1</code>