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Assignment: **03**

Course: **Formal Method in software**
 Engineering

Instructor: **Shakir Ullah**

Statement:

The problem that we're going to solve is finding elements of a sequence satisfying a given predicate. More precisely, we're interested in finding exactly the n^{th} such element, for a given value of n .

Solution:

MACHINE

m_find_nth

OPERATIONS

ll, ii \leftarrow find_nth (aa, bb, pp, nn) =

PRE

aa \in INT \wedge bb \in INT \wedge aa \leq bb \wedge aa-1 \in INT \wedge

pp \in INT \rightarrow BOOL \wedge aa..bb \subseteq dom(pp) \wedge

nn \in INT \wedge nn $>$ 0

THEN

ll, ii : (

ll = bool(card({kk | kk \in aa..bb \wedge pp(kk) = TRUE}) \geq nn) \wedge

ii \in aa..bb \wedge

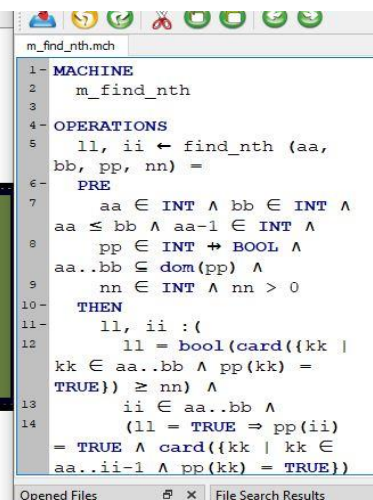
(ll = TRUE \Rightarrow pp(ii) = TRUE \wedge card({kk | kk \in aa..ii-1 \wedge pp(kk) = TRUE}) = nn-1))

END

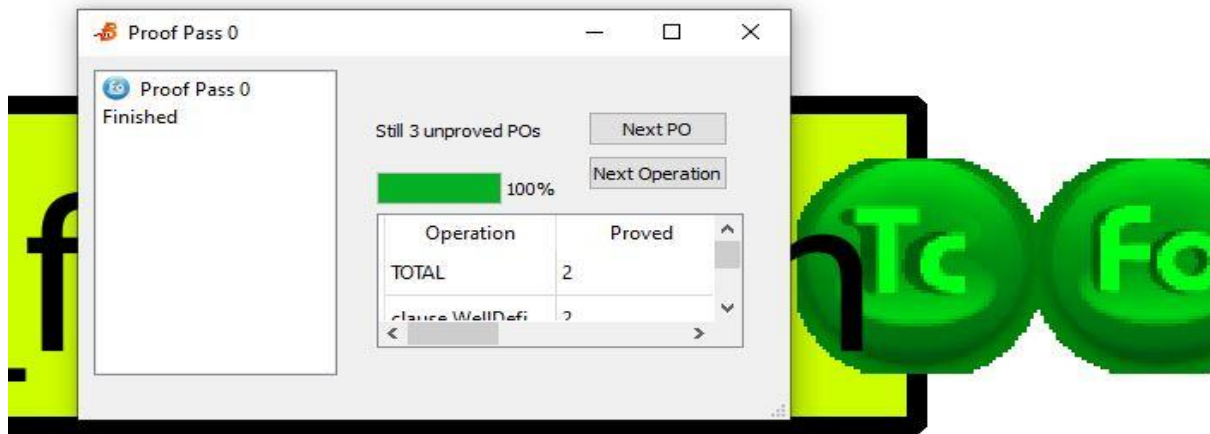
END

OUTPUT:

m_find_nth



```
1- MACHINE
2-   m_find_nth
3-
4- OPERATIONS
5-   ll, ii  $\leftarrow$  find_nth (aa,
6-   bb, pp, nn) =
7-   PRE
8-     aa  $\in$  INT  $\wedge$  bb  $\in$  INT  $\wedge$ 
9-     aa  $\leq$  bb  $\wedge$  aa-1  $\in$  INT  $\wedge$ 
10-     pp  $\in$  INT  $\rightarrow$  BOOL  $\wedge$ 
11-     aa..bb  $\subseteq$  dom(pp)  $\wedge$ 
12-     nn  $\in$  INT  $\wedge$  nn  $>$  0
13-   THEN
14-     ll, ii : (
15-       ll = bool(card({kk |
16-       kk  $\in$  aa..bb  $\wedge$  pp(kk) =
17-       TRUE})  $\geq$  nn)  $\wedge$ 
18-       ii  $\in$  aa..bb  $\wedge$ 
19-       (ll = TRUE  $\Rightarrow$  pp(ii)
20-       = TRUE  $\wedge$  card({kk | kk  $\in$ 
21-       aa..ii-1  $\wedge$  pp(kk) = TRUE}))
```



CODE:

```

MACHINE
Access
SETS USER; PRINTER; OPTION; PERMISSION = { ok, noaccess }
CONSTANTS options
PROPERTIES
options : PRINTER <-> OPTION &
dom( options ) = PRINTER & ran( options ) = OPTION
VARIABLES access
INVARIANT access : USER <-> PRINTER
INITIALISATION access := {}
OPERATIONS
add (uu, pp) =
PRE uu:USER & pp:PRINTER
THEN access := access \/ { uu |-> pp }
END ;

END

```

OUTPUT: