Write a program to find how many items are duplicates (repeats) of earlier items
(a) in a given sorted nonempty list.
(b) in a given list.

After trying the question, scroll down to the solution.
(a) in a given sorted nonempty list.

Let the list be \( L \). Let \( n \) and \( j \) be natural state variables. The result will be reported as \( n' \). Let's call the specification \( S \), defined as

\[
S \equiv n' = \varphi(\langle i: 1\ldots \#L: L i = L(i-1) \rangle) \land t' = t + \#L - 1
\]

Also define

\[
P \equiv 1 \leq j \leq \#L \land n' = n + \varphi(\langle i: j\ldots \#L: L i = L(i-1) \rangle) \land t' = t + \#L - j
\]

The problem is solved by the refinements

\[
S \leftarrow n := 0. \quad j := 1. \quad P
\]

\[
P \leftarrow \text{if } j = \#L \text{ then } \text{ok} \text{ else if } L j = L(j-1) \text{ then } n := n + 1 \text{ else ok.}
\]

\[
j := j + 1. \quad t := t + 1. \quad P \text{ fi}
\]

Proof: NOT YET WRITTEN

(b) in a given list.

Maybe the best way is to check if the list is nonempty, sort it, then use the solution of part (a).