

2024 CpSc Q4

Section: Software Design and Development

Topic: Algorithm Design — Longest String Length in an Array

Question Summary

An array surnames contains a list of surnames. Using a design technique of your choice, design an algorithm to find the number of characters in the longest surname.

Worked Solution

Worked Solution (Structured Pseudocode)

We scan the array once, keeping track of the maximum length seen so far. This is efficient (linear time) and easy to implement in any language.

ALGORITHM LongestSurnameLength(surnames : ARRAY of STRING) RETURNS INTEGER

IF length(surnames) = 0 THEN

RETURN 0 // no surnames supplied

ENDIF

longest ← 0

FOR EACH name IN surnames DO

currentLen ← length(name)

IF currentLen > longest THEN

longest ← currentLen

ENDIF

ENDFOR

RETURN longest

END ALGORITHM

Explanation

- longest holds the best (maximum) length found so far.
- For every surname, compute its length and update longest if it is bigger.
- If the array might be empty, returning 0 is a safe, clearly documented choice.
- Time complexity: $O(n)$ where n is the number of surnames; Space complexity: $O(1)$.

Alternative Design (Structured English)

Set longest to 0. For each surname in the array, count the characters in the surname. If this count is greater than longest, replace longest with this count. When all surnames have been checked, output longest.

Quick Trace Example

Input ["Lee", "Hamilton", "Ng", "McDonald"]

Lengths [3, 8, 2, 8] → longest evolves: $0 \rightarrow 3 \rightarrow 8 \rightarrow 8 \rightarrow 8$.

Return 8.

Final Answer

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Use a single pass with a running maximum of `length(name)`. Pseudocode above returns the number of characters in the longest surname.

Revision Tips

- Know common loop patterns: 'running maximum' and 'running total'.

- Always handle edge cases (empty array, very long names, whitespace).
- Use a clear, consistent naming scheme (e.g., `currentLen`, `longest`).
- Justify complexity: $O(n)$ time, $O(1)$ space is optimal for this task.

Exam Alignment

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Meets the 2024 MI for Q4: a valid algorithm/design using a recognised technique (e.g., structured pseudocode) that correctly computes the length of the longest surname, with appropriate loop and update logic.

