

2024 CpSc Q10

Section: Software Design and Development

Topic: Tracing, Debugging, Scope, and Modularity
(Consecutive Days Algorithm)

Question Summary

- (a) Complete the trace table for the first two iterations of the loop in consecutiveDays.
- (b) State the line number that should be removed to correct the algorithm.
- (c) Name and describe a debugging technique used during execution.
- (d) Explain why the scope of counter is local.
- (e) Describe how modular programming increases both efficiency and maintainability.

Worked Solution

(a) Trace for first two iterations

Line number	counter	index	longestStreak
10	0		
11			-1
12		0	
13	0		
15	1		

12		1	
13	0		
18			0
20	0		

(b) Remove line 13 (SET counter TO 0 at the start of each loop). Resetting every iteration prevents counting consecutive days.

(c) Breakpoint and step-through debugging: pause execution at key lines, then step line-by-line while watching variable values in a 'watch' window (e.g., counter, index, longestStreak) to see where logic diverges from expectations.

(d) counter is declared inside consecutiveDays, so its scope is local to that function. It exists only while the function runs and cannot be accessed outside it.

(e) Efficiency: modules/functions can be developed and tested independently and reused across programs, reducing duplicated effort.

Maintainability: clear, self-contained modules localise changes (fix one function, not the whole program) and make code easier to read and debug.

Final Answer

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(a) Trace rows for the first two iterations are shown in the table above (10→11→12→13→15, then 12→13→18→20).

(b) Remove line 13.

(c) Use breakpoints and step-through execution with a

watch window.

(d) counter is local because it is declared inside the function.

(e) Modularity improves efficiency (parallel development, reuse) and maintainability (isolation of changes, readability).

Revision Tips

- For counting consecutive items, never reset the counter each iteration; only reset when the condition fails.
- Update the longest streak either when the run breaks or once more after the loop (both are present in the fixed algorithm).
- Trace tables list only the moments variables change, with the line number that caused the change.

Exam Alignment

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Matches the 2024 MI: correct first-two-iteration trace; removal of line 13; appropriate runtime debugging technique; correct explanation of local scope; and clear modular-programming benefits.