

Solutions

2.1

Successive totals are 1, 3 and 6. Correct repeated-update method earns M1. Final output 6.

2.2

After comparing 1, smallest becomes 1; comparing 4 leaves it at 1. Correct update/retain sequence. Final minimum 1.

2.3

Input n followed by a decision testing $n \geq 0$. The yes branch outputs nonnegative and the no branch negative; both are labelled correctly. Both output branches reach a stop, with coherent arrows and appropriate process/decision/input-output symbols. Zero follows the nonnegative branch.

2.4

First middle is 3, value 11. Since 14 is greater, set low to 4; next middle is 5, value 17. Set high to 4; next middle is 4, value 14, found. The compared middle indices are 3, 5, 4.

3.1

- (a) The original loop adds 1, 2 and 3. It outputs 6 rather than 10.
- (b) The strict condition excludes n . Use i less than or equal to n .
- (c) Correct output for 4 is 10. For 0, the corrected loop executes zero times and outputs the initial total 0. The input restriction excludes negative and noninteger n .

3.2

- (a) First remainder is $48 \text{ MOD } 18 = 12$, giving pair (18,12). Next remainder $18 \text{ MOD } 12 = 6$ gives (12,6). Final remainder $12 \text{ MOD } 6 = 0$ gives (6,0), so output 6.
- (b) The remainder must use the old a and b ; overwriting them first changes the division. A temporary r preserves it.
- (c) For positive b , the new nonnegative remainder is strictly smaller than b . A strictly descending sequence of nonnegative integers reaches zero, so the procedure terminates. Euclidean remainder replacement preserves common divisors, and the final output is the greatest common divisor.
- (d) The zero test immediately outputs a without taking MOD by zero.