

Trace. Change. Write.

Three small exercises for moving from reading an algorithm to writing one. Try this page first; worked answers are on page 2.

01 Predict the output

DECLARE creates an integer variable; $\leftarrow$ assigns a value. FOR includes both limits. MOD gives the remainder after division. Follow the IF condition to decide when Total changes.

```
DECLARE Total, Number : INTEGER
Total  $\leftarrow$  0
FOR Number  $\leftarrow$  1 TO 4
    IF Number MOD 2 = 0 THEN
        Total  $\leftarrow$  Total + Number
    ENDIF
NEXT Number
OUTPUT Total
```

Number	Number MOD 2 = 0	Total after loop body
1		
2		
3		
4		

Final output: _____

02 Change one requirement

Add the odd numbers from 1 through 7. Change the limit and the condition. Predict the result before you run it.

New condition: _____ Predicted output: _____

03 Write from a blank page

Input five whole-number scores, each from 0 to 100 inclusive. Ask again after an invalid score. Add only accepted scores and output their average. Assume numeric input.

Use a separate sheet. Test ordinary values, 0, 100, -1 and 101. A rejected value must not count as one of the five accepted scores.

WORKED ANSWERS

Check your reasoning.

A correct output is useful. Knowing why the algorithm produces it is what lets you change it safely.

01 Only the even values are added

Total starts at 0. After Number = 1, 2, 3, 4, the totals are 0, 2, 2, 6. The final output is 6: only 2 and 4 pass the condition.

02 Select the odd values instead

Use FOR Number $\leftarrow$ 1 TO 7 and IF Number MOD 2 = 1 THEN. The result is 16, from 1 + 3 + 5 + 7. With a limit of 1, the result should be 1.

03 Validate inside the counting loop

REPEAT runs at least once; UNTIL stops when its condition is true. AND requires both comparisons to be true. REAL can hold a fractional average.

```

DECLARE Score, Total, Count : INTEGER
DECLARE Average : REAL
Total  $\leftarrow$  0
FOR Count  $\leftarrow$  1 TO 5
    REPEAT
        INPUT Score
        UNTIL Score  $\geq$  0 AND Score  $\leq$  100
        Total  $\leftarrow$  Total + Score
    NEXT Count
Average  $\leftarrow$  Total / 5
OUTPUT Average
  
```

- 10, 20, 30, 40, 50 $\rightarrow$ average 30.
- Five 0s $\rightarrow$ average 0. Five 100s $\rightarrow$ average 100.
- -1 and 101 $\rightarrow$ ask again; neither changes Total or uses a valid-score slot.

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