

Exercise walk-through

Recursion ■ 4.16

eXercise

You must be able to

- understand that a **recursive** 递归 method calls itself
- identify the **base case** 基准情形 that stops the recursion
- identify the **recursive case** 递归情形 that moves toward the base case

Method — Recursion

A **recursive** method calls **itself**. It needs:

- a **base case** that stops the recursion, and
- a **recursive case** that moves the problem toward the base case.

```

k+ktint+w n+nfactp(k+ktint+w nnp)+w p
+w      kif+w p(nn+w oo=+w l+m+mi1p)+w kreturn+w l+m+mi1p;+w      c+c1// base case
+w      kreturn+w nn+w o*+w nfactp(nn+w o+w l+m+mi1p)p;+w      c+c1// recursive case
p

```

Method — Recursion

Without a base case, the recursion never stops.

Method — Unwinding the calls

`fact(3)` calls `fact(2)`, which calls `fact(1)`. The base case returns 1, then the waiting calls finish in reverse: $\text{fact}(2) = 2 * 1 = 2$, then $\text{fact}(3) = 3 * 2 = 6$. Each call pauses until the one below it returns.

Practice 2.1 ■ 1 mark

Define a recursive method.

Solution 2.1

Method: Recursion

Worked steps

a method that calls itself **B1**.

Practice 2.2 ■ 1 mark

State the purpose of a base case.

Solution 2.2

Worked steps

it stops the recursion so it does not run forever **B1**.

Practice 2.3 ■ 2 marks

For the `fact` example above, state the value of `fact(3)`.

Solution 2.3

Worked steps

$$3 \times 2 \times 1 = 6 \quad \text{M1} \quad \text{A1}.$$

Exam-style 3.1 ■ 1 mark

A recursive method is one that

A never returns

B calls itself

C always uses a loop

D must be static

Solution 3.1

Method: Recursion

A never returns

B calls itself



C always uses a loop

D must be static

Worked steps

B.

Exam-style 3.2 ■ 1 mark

The part that stops the recursion is the

A recursive case

B base case

C parameter

D return type

Solution 3.2

Method: Recursion

A recursive case

B base case 

C parameter

D return type

Worked steps

B.

Exam-style 3.3 ■ 1 mark

```
int f(int n) { if (n == 0) return 0; return n + f(n - 1); }.
```

(a) State $f(0)$.

(b) State $f(3)$.

(c) Name the case where $n == 0$.

Solution 3.3

Method: Recursion

Worked steps

(a) 0 **B1**. (b) $3 + 2 + 1 + 0 = 6$ **B1**. (c) the base case **B1**.