

15. The letters $F_0, F_1, F_2, \dots, F_N, \dots$, where $N \geq 0$, are used to identify the N th term of the sequence of Fibonacci numbers that starts as follows.

0, 1, 1, 2, 3, 5, 8, 13, ...

With the exception of the leading 0 and 1 (the zeroth term and 1st term), the terms in the sequence are the sum of the two preceding terms. For example, F_5 is the 5th term of the sequence, which is 5, and is the sum of the 3rd and 4th terms, which are 2 and 3 respectively.

- (a) State the value of the 8th term in the sequence.

[1]

The following method, `fibonacci(N)`, generates the N th term in the sequence. The `return` statement returns the value that the method generates.

```
fibonacci(N)
  if (N=0 OR N=1) then
    return N
  else
    return (fibonacci(N-1) + fibonacci(N-2))
  end if
```

- (b) Trace `fibonacci(4)`, showing the different levels of recursion.

[3]

- (c) Construct a non-recursive algorithm to generate Fibonacci numbers.

[6]

- (d) Construct an algorithm that will **output** the first N terms of the sequence. You should use `fibonacci()`, the method defined above.

[3]

Recursive programs written in high level languages require the use of particular structures to support their execution.

- (e) Describe how a stack is usually employed in the running of a recursive algorithm.

[2]