1995 Paper 1 Question 10

Programming in Modula-3

The following Modula-3 program uses exceptions. What does it print on its standard output? Explain your answer.

```
MODULE Main;
IMPORT Fmt, IO;
EXCEPTION Bad;
VAR j: CARDINAL := 0;

PROCEDURE P (i: CARDINAL): CARDINAL RAISES {Bad} =
  BEGIN
    IF i = 0 THEN RAISE Bad END;
    RETURN j + 100 DIV i;
  END P;

PROCEDURE Q (i: CARDINAL): CARDINAL RAISES {Bad} =
  BEGIN
    TRY
      RETURN P (i);
    FINALLY
      j := j + i + 1;
    END;
  END Q;

VAR k: CARDINAL := 0;
BEGIN
  TRY
    k := Q (1); k := k + Q (0);  (**)
  EXCEPT
     Bad => IO.Put ("Bad Raised\n");
  END;
  IO.Put ("k = " & Fmt.Int (k) & "\n" &
          "j = " & Fmt.Int (j) & "\n");
END Main.
```

Rewrite procedures `P`, `Q` and the main program so that they perform the same calculations and have the same side-effects without using exceptions.

If the line marked `(**)` is replaced by the line:

```
k := Q (1) + Q (0);
```

what can you say about the output from the program?

[20 marks]