"Nuclear reactor calculations with the group diffusion equations on digital computers." Doctoral dissertation, Technische Hogeschool, Delft.

7. Acknowledgements

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Correspondence

An impossible program

To the Editor,
The Computer Journal.

Dear Sir,

Strachey's letter* under this title gave rise to some discussion among my colleagues, some of it along the lines of ApSimon's letter,† and it recalled to me similar discussions in my school-days about the validity of *reductio ad absurdum* proofs in geometry. If ApSimon's objections were valid, they would apply to all proofs of this sort, and invalidate a fair part of the structure of mathematics from Euclid onward.

Much more interesting to me is a corollary which I have not seen stated elsewhere. Consider the following program:

```
begin integer a, b, c, m;
    for m := 3, m + 1 while true do
        for a := 1 step 1 until m do
            begin for b := 1 step 1 until a do
                        for c := a step 1 until a + b do
                            if a^m + b^m = c^m then go to out;
                if a > 2 then begin
                for b := 1 step 1 until m do
                    for c := m step 1 until m + b do
                        if m^a + b^a = c^a then go to out end
                            if a
            end for a and for m;
    out: end program
```

This, if I have not made any errors in writing it, is a rather inefficient search program for a counter-example to Fermat's last theorem, covering all possible cases in a single denumerable infinity (this is important). Application of the function T to this program would constitute a proof or a refutation of this theorem. (The inefficiency of the program is irrelevant for this purpose; one might well imagine that simplicity would be more helpful.) A similar technique would apply immediately to a great number of unproved conjectures in number theory. Alas, that it cannot be done in this way!

Yours sincerely,
BRYAN HIGMAN.

Windy Sayles,
Felden,
Hemel Hempstead.
7 May 1965.

* This *Journal*, January 1965, p. 313.
† *Ibid.*, April 1965, p. 72.

To the Editor,
The Computer Journal.

Dear Sir,

We wish to bring to the notice of your correspondent, Mr. ApSimon ("An impossible program", this *Journal*, April 1965, p. 72), the method of proof by *reductio ad absurdum*, in which a hypothesis is proved false by assuming its truth and deriving a contradiction. In this instance, the hypothesis is:

(i) There is (i.e., it is possible to write) a Boolean function with a routine as argument whose value is **true** if the routine terminates and **false** if it does not.

Call such a function $T[R]$.

From (i) it follows, as in Strachey's letter (this *Journal*, January, 1965, p. 313):

(ii) There is a routine P which terminates if $T[P] =$ **false**, and fails to if $T[P] =$ **true**.

This is a contradiction. Hence the hypothesis (i) is false, which was to be proved.

Yours faithfully,
W. F. LUNNON,
C. F. J. OUTRED.

Department of Computer Science,
The University,
Manchester 13.
26 May 1965.

[*Correspondence contd. on next page*]