Correspondence

DEAR EDITOR,

I have derived the general solution to Canon Eperson's second conjecture in terms of four parameters t, f, g, h (one or three of which must be odd). The solution, up to a common multiplier, is as follows: If

$$2y + 1 = t^2 + f^2 + g^2 + h^2,$$

$$2u + 1 = t^2 + f^2 - g^2 - h^2 + 2(g - h)t + 2(g + h)f,$$

$$2v + 1 = t^2 - f^2 + g^2 - h^2 + 2(h - f)t + 2(h + f)g,$$

$$2w + 1 = t^2 - f^2 - g^2 + h^2 + 2(f - g)t + 2(f + g)h,$$

then

$$(2u + 1)^2 + (2v + 1)^2 + (2w + 1)^2 = 3(2y + 1)^2,$$

the sufficiency of which can be checked by using *DERIVE*. For the present purpose a proof of the necessity is not required.

As any positive integer can be represented as the sum of four squares, [1, pp. 302-303] all one has to do, for a given odd integer $2y + 1$, is to find a four square representation of it, and the values of t, f, g, h and hence those of u, v, w follow at once. For example

$$39 = 5^2 + 3^2 + 2^2 + 1^2,$$

then taking $t = 5, f = 3, g = 2, h = 1$ one obtains

$$3 \times 39^2 = 57^2 + 15^2 + 33^2.$$

Whether this is deemed to be elementary is a matter of definition, but as the general solution depends on the representation of integers as the sum of four squares (or three triangular numbers) it is doubtful that any solution will be more elementary than this.

Reference

1. G. H. Hardy and E. M. Wright, *An introduction to the theory of numbers*, Oxford University Press (Fourth edition. 1960).

Yours sincerely,

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DEAR EDITOR,

I write with reference to the article by Harold Williams in *The Mathematical Gazette* **82** (July 1998), entitled The Mathematics of Flat Green Bowling. From his disparaging remarks about my mathematical model of bowling I gather that he did not bother to look at the references

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