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Commentary

Comment: Paper on the progress of pure mathematics "proof of $3x + 1$ conjecture"

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Abstract

The unresolved problem in number theory: the $3x+1$ problem, deeply loved by math enthusiasts. I saw a paper titled "Proof of $3x+1$ Conjecture" in the Journal of Pure Mathematical Progress (ISSN Print: 2160-0368), and its proof was incorrect.

Introduction

The $3x+1$ problem [1,2] is one of the unsolved problems in number theory.

A lot of people have been attracted to solving the problem.

Paper in the Journal of Pure Progress in Mathematics on "Proof of the $3X+1$ Conjecture" [3], the proof of it [3] is incorrect.

There are two errors, the first is a correctable error and another is a fatal mistake.

Detailed comments

Modifiable errors

Extraction part (i): See the top section on page 15 [3].

Proposition 1: $4^r \in C_4 (r \in \mathbb{Z}^+)$, and its row number $n = 4^{r-1} - \frac{4^{r-1} - 1}{3}$.

Proof: $\because 4^r - 4 = 4(4^{r-1} - 1) = 4[(2^{r-1})^2 - 1] = 4(2^{r-1} + 1)(2^{r-1} - 1)$

$3 \mid (2^{r-1} + 1) \cdot 2^{r-1} \cdot (2^{r-1} - 1)$, but $3 \nmid 2^{r-1}$.

$$\therefore 3 \mid (2^{r-1} - 1)(2^{r-1} + 1).$$

$$\therefore 6 \mid 4(2^{r-1} - 1)(2^{r-1} + 1).$$

$$\text{Let } 4^r - 4 = 6(n-1) \quad (n \in \mathbb{Z}^+).$$

$$\therefore 4^r = 6(n-1) + 4.$$

$$\therefore 4^r \in C_4. \tag{i}$$

$$\therefore r \in \mathbb{Z}^+$$

$$\therefore \{3 \mid (2^{r-1} + 1) \times (2^{r-1}) \times (2^{r-1} - 1)\} \text{ Inaccurate}$$

$$\therefore r = 1 \in \{r \in \mathbb{Z}^+\}$$

$$\Rightarrow (2^{1-1} + 1) \times (2^{1-1}) \times (2^{1-1} - 1) \neq \text{An integral multiple of 3}$$

$$\text{Only: } 1 < r \in \mathbb{Z}^+$$

$$\Rightarrow \{3 \mid (2^{r-1} + 1) \times (2^{r-1}) \times (2^{r-1} - 1)\}$$

Correction method: setting $1 < r \in \mathbb{Z}^+$



Non-modifiable fatal errors

Extraction part (ii): See the lower end of page 11 and the upper end of page 12.

$$\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 7 & 8 & 9 & 10 & 11 & 12 \\ \dots & \dots & \dots & \dots & \dots & \dots \\ 6n-5 & 6n-4 & 6n-3 & 6n-2 & 6n-1 & 6n \\ \dots & \dots & \dots & \dots & \dots & \dots \end{pmatrix} \Rightarrow \begin{pmatrix} 4 \\ 10 \\ \dots \\ 6n-2 \\ \dots \end{pmatrix} \tag{ii}$$

The fourth column in Figure (ii): $6n-2$

$$\{4, 10, 16, 22, 28, 34, 40, 46, 52, 58, 64, \dots, (6n-2), \dots\} \in (6n-2) \tag{1}$$

The first line, $n=1, (6n-2)=4$

The second line, $n=2, (6n-2)=10$

The third line, $n=3, (6n-2)=16$

.....

The author takes n as the serial number of each line.

The original author added: $(6n-2) = 6(n-1)+4$, This is correct

Author's formula: $4^r = 6(n-1)+4$, There will be mistakes.

Extraction part (iii): See the top section on page 15.

$$\therefore 4^r = 6(n-1)+4$$

$$\therefore 4^r \in C_4$$

The following mathematical induction proves that row

number of 4^r is $4^{r-1} - \frac{4^{r-1}-1}{3} (r \in \mathbb{Z}^+)$.

Proof: 1) As $r = 1, n = 4^{1-1} - \frac{4^{1-1}-1}{3} = 1$, the conclusion is correct.

2) It is assumed that the conclusion is correct as $r=s (s \in \mathbb{Z}^+, s \geq 1)$, that is

$$4^s = 6(4^{s-1} - \frac{4^{s-1}-1}{3} - 1) + 4. \tag{iii}$$

Let's look at $n=2$. The second line gets: $4^r = 6(n-1)+4=10$

$$\Rightarrow 4^r = 10 \Rightarrow r \notin \mathbb{Z}^+$$

Conflict with $r \in \mathbb{Z}^+$. See: (i).

Let's look at $n=3$. The second line gets: $4^r = 6(n-1)+4 = 16$

$$\Rightarrow 4^r = 16 \Rightarrow 2 = r \in \mathbb{Z}^+$$

Let's look at $n=4$. The second line gets: $4^r = 6(n-1)+4=22$

$$\Rightarrow 4^r = 22 \Rightarrow r \notin \mathbb{Z}^+$$

Conflict with $r \in \mathbb{Z}^+$. See: (i).

The truth is:

From formula (1):

$$\{4, 10, 16, 22, 28, 34, 40, 46, 52, 58, 64, \dots, (6n_1-2), \dots\} \in (6n-2)$$

$$\{4, 10, 16, 22, 28, 34, 40, 46, 52, 58, 64, \dots, (6n_1-2), \dots\} \in (6n-2) \notin 4^r.$$

$$(6n-2) = 6(n-1)+4 \Rightarrow \{4, 16, 64, \dots, 4^n, \dots\} \in 4^r$$

Many numbers are missing: $\{10, 22, 28, 34, 40, 46, 52, 58, \dots\}$
 $\{10, 22, 28, 34, 40, 46, 52, 58, \dots\} \notin 4^r.$

$$\therefore 4^r \neq 6(n-1)+4 = 6n-2$$

$$\therefore 4^r \notin C_4$$

When the author [1] chooses n as the serial number and ($1 < r \in \mathbb{Z}^+$) cannot obtain:

$$6(n-1)+4 = 4^r \in C_4$$

Get: The author did not prove $(3X+1)$.

Conclusion

If in [3] the author corrects the second error, then [3] the author's method cannot prove $(3X+1)$.

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