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On Cardinal Numbers and Self Adjusting \mathcal{M} -sets. A Mathematical Letter.

J.I. Pillay¹

Introduction

This is a technical letter where we outline certain considerations involving cardinal numbers. Notations and terminology follow similarly from our previous article[1]. The mechanistic approach to the logical development of arithmetic in our previous article had proven so useful, that we wish here to extend its application to cardinality. Our Approach involves a mechanistic approach similar to that of our previous article with no reference to formal set theory[2].

Outline

We will again form our analysis on \mathcal{B}_i as these can be paired of with the naturals N .

A self adjusting \mathcal{M} -set is best seen via the following example:

If it were required, via the existing mechanisms surrounding arithmetic operations, that a representation to be formed expressing $\frac{1}{11}$, is met with recursion, as can be seen from the multiplication $1 \approx (0.1)(11) = 1.1$. As such, the only means of removing the 0.1 in 1.1 via the multiplicative mechanism is by adjusting the term to which 11 is multiplied. i.e (0.011)(11). To remove the 0.01 we multiply (0.01011)..(0.0101011) and so on.

This necessary recursion or 'adjusting' of the (0, 1) symbols is informally defined to be a self adjusting mechanism.

There are two ways in which it seems possible to form an irrational number.

- A) Via operations on N .
- B) Via Construction.

The famous diagonalisation argument of Cantor can be seen as a form of constructing irrationals.

To see the mechanisms at play in the formation of rationales we introduce the following notation for a number followed by a decimal value :

$$\mathfrak{S} : n : \overline{P\{p\}}$$

P here denotes the decimal portion of the number and $\{p\}$, a value indicating the current position of the decimal if n, P were combined. From this one can define a rational number as :

$$\sum_{p=1}^M n : \overline{P\{p\}} \tag{1}$$

¹With fond memories of a true friend and advisor without whom many endeavors would not have been possible. For Dr.W.E.Meyer

Where it is necessarily required that M be finite. This tells us that in order for \mathfrak{S} to be rational, it is required that $\forall p_i, p_{i+1} \in pos(P)$ there is a finite maximum ℓ such that $p_{i+1} - p_i \leq \ell$. For if this were not the case then no finite summation of the form (1) would be capable of forming a natural number. This brings us to the conclusion that The only other mutually exclusive case of mechanisms forming P is the case where no finite ℓ exists, specifically, no maximum measure between elements $p_i, p_{i+1} \in pos(P)$ exists. And in all such cases, since no element of the natural can be formed via a finite summation, it is conceivable that no mechanistic set exists between the rationals and irrationals, thus expressing that no cardinal can be formed between :

$$\aleph_1 < C < 2^{\aleph_1}$$

References

- [1] J.I.Pilly A New Discourse on Incompleteness and Proof Systems (2012). HAL
- [2] Cohen, Paul J. (December 15, 1963). "The Independence of the Continuum Hypothesis". *Proceedings of the National Academy of Sciences of the United States of America* 50 (6): 1143-1148. doi:10.1073/pnas.50.6.1143. JSTOR 71858. PMC 221287. PMID 16578557.
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