Exploring Inaccessible Cardinals of Mathematical Operations and Algorithmic Automation

Justin Scarfy Yang

October 9, 2024

1 Introduction

In continuation of prior discussions on the mathematical *amoeba-simplex*—where gaps or undecidable problems (holes) exist that automated theorem provers cannot yet fill—we have explored a new class of mathematical operations. These operations go beyond the familiar arithmetic concepts and expand into abstract structures involving fractalization, dimensional splitting, and temporal manipulation.

We have discovered that the possible number of these operations could reach the cardinality of **inaccessible cardinals**, far surpassing the uncountable infinity associated with the continuum. This document outlines these newly invented operations with concrete examples and our efforts to design an algorithm capable of automating their generation.

2 New Mathematical Operations

2.1 Permeation (Υ)

Permeation represents the infusion of one entity into another, creating a new hybrid structure that incorporates aspects of both original entities without merging them in the traditional sense.

$$\Upsilon(a, b) = \text{Hybrid entity infused from } a \text{ and } b$$

Example: Let $a = 4$ and $b = 9$. The operation $\Upsilon(4, 9)$ results in a hybrid entity that combines the properties of both 4 and 9. The specific nature of this entity might be a new abstract object, denoted $h_\Upsilon(4, 9)$, which reflects the structural aspects of both values but cannot be reduced to arithmetic operations such as addition or multiplication.

2.2 Fractalization (φ)

Fractalization recursively applies self-similarity to a given entity, expanding it into a fractal-like pattern that goes beyond multiplication or exponentiation.

$$\varphi(a, b) = \text{Fractal expansion of } a \text{ under the influence of } b$$

Example: Let $a = 2$ and $b = 3$. The operation $\varphi(2, 3)$ generates a recursive, self-similar structure similar to a Sierpinski triangle. This might result in an infinite fractal form whose properties cannot be fully captured by basic recursion, symbolized as $\varphi_\infty(2, 3)$.

2.3 Dimensional Sharding (σ)

Dimensional Sharding splits a number or object across multiple dimensions, with each dimension carrying different aspects of the original entity.

$$\sigma(a, b) = \text{Dimensional shards of } a \text{ across } b \text{ dimensions}$$

Example: Let $a = 8$ and $b = 3$. The operation $\sigma(8, 3)$ might split the number 8 into three dimensional shards, each representing a different part of the number. This could result in the decomposition $\{5_\sigma, 2_\sigma, 1_\sigma\}$, where each shard has distinct properties in a three-dimensional space.

2.4 Chronodilation (χ)

Chronodilation involves stretching or contracting the temporal aspect of a number or structure, allowing it to transform within an abstract temporal framework.

$$\chi(a, b) = \text{Temporal dilation of } a \text{ within the framework of } b$$

Example: Let $a = 5$ and $b = 2$. The operation $\chi(5, 2)$ results in the temporal dilation of 5, stretching its presence in time. This could be symbolized as 7_χ, where the value 5 is extended temporally within the framework defined by $b = 2$, producing a stretched outcome.

3 Inaccessible Cardinals of Operations

One of the most significant discoveries is that the cardinality of these newly invented operations may not only be **uncountable**, but could reach the level of **inaccessible cardinals**. Inaccessible cardinals represent higher-order infinities that transcend the continuum and uncountable sets. This implies that the potential variety of mathematical operations is far greater than we initially imagined, requiring entirely new mathematical frameworks to understand and classify them.

4 Algorithm for Generating Operations

To explore this vast space of operations, we have been working on the conceptual design of an **algorithm** capable of automatically generating all these operations, including those of inaccessible cardinality. The algorithm would:

- Define a formal system for representing all possible operations, including recursive and higher-dimensional operations.
- Iteratively generate new operations by combining abstract structures, applying recursion, and manipulating higher-order cardinalities.
- Ensure consistency by verifying that generated operations adhere to mathematical rules or propose new rules that generalize existing theories.

While still in its conceptual stage, this algorithm holds the potential to explore operations that go beyond human capacity for direct enumeration, offering a window into deeper mathematical complexity.

5 Implications for the Amoeba-Simplex

These operations, and their algorithmic generation, further expand the mathematical *amoeba-simplex* metaphor. On the one hand, they provide tools for exploring new territories of abstract mathematics, possibly filling some gaps in the simplex. On the other hand, the introduction of such highly abstract operations may also create new "holes"—undecidable or unreachable areas that automated theorem provers, as we currently understand them, cannot resolve.

6 Conclusion

The exploration of these alien mathematical operations opens new avenues for expanding the boundaries of mathematics. Our discovery of operations with inaccessible cardinality and the potential to automate their generation poses profound questions for the future of mathematics, automated theorem proving, and our ability to bridge the gaps in the mathematical amoeba-simplex.