

Communication

Not peer-reviewed version

A Solution to the P Versus NP Problem

[Alan Z](#)*

Posted Date: 17 December 2025

doi: 10.20944/preprints202510.1418.v4

Keywords: Gödel's incompleteness theorem; nonsequivalent transformations



Preprints.org is a free multidisciplinary platform providing preprint service that is dedicated to making early versions of research outputs permanently available and citable. Preprints posted at Preprints.org appear in Web of Science, Crossref, Google Scholar, Scilit, Europe PMC.

Copyright: This open access article is published under a [Creative Commons CC BY 4.0 license](#), which permit the free download, distribution, and reuse, provided that the author and preprint are cited in any reuse.

Disclaimer/Publisher's Note: The statements, opinions, and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions, or products referred to in the content.

Communication

A Solution to the P Versus NP Problem

Alan Z

Department of Physics, Dali University, Dali 671003, P. R. China; 15279509312@139.com

Abstract

People create facts rather than describe them; they formulate mathematical concepts rather than discover them. However, why can people design different mathematical concepts and use different tools to change reality? People establish the correspondence between theory and reality to use theory to explain reality. However, this implies that theory cannot change reality—if theory was capable of altering reality, the correspondence between theory and reality would no longer hold. Similarly, people have introduced the correspondence between mathematical concepts and sets. This implies that people cannot construct different mathematical concepts. If different mathematical concepts could be constructed, the correspondence between mathematical concepts and sets would no longer hold. Unlike traditional approaches that base mathematical concepts on equivalent transformations—and, by extension, on the principle that correspondence remains unchanged—this theory is founded on nonequivalent transformations. By constructing a special nonequivalent transformation, I demonstrate that for a problem $P(a)$ in the complexity class P and its corresponding problem $P(b)$ in the complexity class NP , $P(a)$ is a P nonequivalent transformation of $P(b)$, and $P(b)$ is an NP nonequivalent transformation of $P(a)$. That is, the relationship between $P(a)$ and $P(b)$ is neither $P=NP$ nor $P\neq NP$.

Keywords: Gödel's incompleteness theorem; nonequivalent transformations

1. Introduction

The core of this paper lies in constructing three unique nonequivalent transformations through Gödel's Incompleteness Theorem.

2. Proof

2.1. Introduction to Gödel Numbering [1]

Theorem 2.2 Gödel numbering assigns a unique natural number (called a Gödel number) to every well-formed expression in a formal system. This is achieved through a one-to-one mapping that ensures that each formula or sequence has a distinct numerical representation. The key insight is that by using the properties of prime numbers and factorization, the system can encode complex logical structures into integers, which can then be manipulated arithmetically within the formal system itself.

Step-by-Step Mechanics

The encoding process involves the following steps:

(1) Symbol assignment:

A unique prime number is assigned to each primitive symbol in the formal alphabet. For instance:

Logical connectives such as “¬” (negation) might be assigned a value of 2.

Variables such as “x” could be assigned a value of 3.

Quantifiers such as “∀” (universal quantifiers) might obtain a score of 5.

Parentheses or other delimiters receive distinct primes (e.g., “(” = 7, “)” = 11).

This ensures that all symbols have unique identifiers

(2) Formula Encoding:

Consider a formula φ composed of a sequence of symbols: $s_1, s_2, \dots, s_k$.

The Gödel number of φ , denoted $[\varphi]$, is calculated as:

$$[\varphi] = p^{c(s_1)}_1 \times p^{c(s_2)}_2 \times \dots \times p^{c(s_k)}_k$$

where:

- (1) p_i is the i -th prime number (e.g., $p_1 = 2, p_2 = 3, p_3 = 5, \dots$).
- (2) $c(s_i)$ is the numerical code assigned to symbol s_i .

(3) Decoding and Properties:

Owing to the fundamental arithmetic theorem (which states that every integer has a unique prime factorization), each Gödel number can be uniquely decoded back into the original symbol sequence.

This bijective mapping ensures that operations on formulas (e.g., concatenation or substitution) can be represented as arithmetic operations on their Gödel numbers.

To construct Formula G[2], a self-referential statement is formed via Gödel numbering. Specifically, the expression $(\forall x)\neg \text{Dem}(x, \text{sub}(n, 13, n))$, which asserts that no proof exists for the formula obtained by substituting its own Gödel number into itself, is assigned a unique Gödel number, say n .

Definition 2.3 If we only modify the Formula Encoding in Gödel numbering as follows:

Consider a formula φ composed of a sequence of symbols: $s_1, s_2, \dots, s_k$.

The Gödel number of φ , denoted $[\varphi]$, is calculated as:

$$[\varphi] = p^{c(s_1)}_{i+1} \times p^{c(s_2)}_{i+2} \times \dots \times p^{c(s_k)}_{i+k}$$

where:

- p_i is the $(i+1)$ -th prime number (e.g., $p_1 = 3, p_2 = 5, p_3 = 7, \dots$).
- $c(s_i)$ is the numerical code assigned to symbol s_i .

This results in Formula H replacing Formula G.

Definition 2.4 In Gödel’s incomplete theorems, it is entirely possible to construct undecidable formulas using numerical variables other than x (such as y, z, k , etc.).

$P(M)$: A set containing Formula G and related formulas

$P(N)$: A set containing Formula H and analogs

Peano arithmetic is denoted as X .

$P(M)$ is defined as one extension of X , and $P(N)$ is defined as another.

To construct Formula G, the numerical variable y is associated with prime number 13, and the formula $(\forall x)\neg \text{Dem}(x, \text{sub}(n, 13, n))$ is associated with the unique number n .

Proof 2.5 If Formula G is denoted by $(13, n)$ or $(13, G_1)$, then we can define a sequence of denotations for formulas in $P(M)$ as follows: $(13, G_1), (17, G_2), (19, G_3), \dots, (P_k, G_k)$, and similarly for $P(N)$: $(13, H_1), (17, H_2), (19, H_3), \dots, (P_k, H_k)$.

Define the operation $\mathcal{E}$ such that the following conditions are satisfied:

$$X_1=13, Y_1=\mathcal{E}(G_1), Z_1=\mathcal{E}(H_1)$$

$$X_2=17, Y_2=\mathcal{E}(G_2), Z_2=\mathcal{E}(H_2)$$

...

$$X_k=P_k, Y_k=\mathcal{E}(G_k), Z_k=\mathcal{E}(H_k)$$

(K is an even)

$$Y_1, Y_2, \dots, Y_k \in \mathbb{Z}$$

$$\forall i, j \in \{1, 2, \dots, k\} (i \neq j \Rightarrow Y_i \neq Y_j)$$

$$Z_1, Z_2, \dots, Z_k \in \mathbb{Z}$$

$$\forall i, j \in \{1, 2, \dots, k\} (i \neq j \Rightarrow Z_i \neq Z_j)$$

Definition 2.6 Define sequence G : G contains the elements $a_1, a_2, \dots, a_k$. The ordering of the elements in G is $a_1, a_2, \dots, a_k$.

$$a_1=X_1+Y_1i$$

(Y_1i indicates that Y_1 is the value of the imaginary part of the complex number a_1)

$$a_2=X_2+Y_2i$$

..

$$a_k=X_k+Y_ki$$

The group H is defined as follows: H contains the elements $b_1, b_2, \dots, b_k$. The ordering of the elements in H is $b_1, b_2, \dots, b_k$.

$$b_1=X_1+Z_1i$$

(Z_1i indicates that Z_1 is the value of the imaginary part of the complex number b_1)

$$b_2=X_2+Z_2i$$

..

$$b_k=X_k+Z_ki$$

All the elements in group G are assigned to subgroup $G-A$ and subgroup $G-B$ via a specific random allocation method Y , ensuring that the number of elements in subgroup $G-A$ is equal to the number of elements in subgroup $G-B$.

Using the same allocation method Y , all the elements in group H are assigned to subgroup $H-A$ and subgroup $H-C$ so that the number of elements in subgroup $H-A$ is equal to the number of elements in subgroup $H-C$.

We can employ different allocation methods.

When the absolute value of the difference between the sum of the imaginary parts in subgroup $H-C$ and that in subgroup $H-A$ is the maximum value (denoted as m_1) or the minimum value (denoted as m_2) and this maximum m_1 (or minimum m_2) is unique among all possible allocation schemes, we denote this allocation method as K (for the maximum case) or K^* (for the minimum case), respectively.

The allocation method K (or K^*) must also satisfy the following conditions:

1. When allocation is performed via method K (or K^*), the absolute value n_1 of the difference between the sum of the real parts in subgroup $G-B$ and subgroup $G-A$, or equivalently, the absolute value of the difference between the sum of the real parts in subgroup $H-C$ and subgroup $H-A$, must be unique and neither a maximum nor a minimum.
2. When allocation is performed via method K (or K^*), the absolute value n_2 of the difference between the sum of the imaginary parts in subgroup $G-B$ and subgroup $G-A$ must be neither a maximum nor a minimum.

The allocation method K can be achieved via bubble sorting. Since bubble sorting is a polynomial-time algorithm, it is a problem in class P .

Definition 2.7 Proposition $P(a)$ is formulated as follows: What allocation method can be used to make the absolute value of the difference between the sum of the imaginary parts in subgroup $H-C$ and that in subgroup $H-A$ reach the maximum value m_1 or the minimum value m_2 ?

Proposition $P(b)$ is formulated as follows: Under what allocation method is K the absolute value n_1 of the difference between the sum of the real parts in subgroup $G-B$ and subgroup $G-A$ determined?

Three nonequivalent transformations are constructed:

The first nonequivalent transformation A is as follows:

If Peano arithmetic is expressed as X , then proposition Q is expressed as proposition $P(b)$, and $P(b)$ is a nondeterministic polynomial solvable problem.

The second nonequivalent transformation B :

If Peano arithmetic is expressed as proposition $P(N)$, then proposition Q is expressed as proposition $P(a)$, and $P(a)$ is a polynomial-time solvable problem.

Thus, $P(a)$ is a P nonequivalent transformation of $P(b)$, and $P(b)$ is an NP nonequivalent transformation of $P(a)$. That is, the relationship between $P(a)$ and $P(b)$ is neither $P = NP$ nor $P \neq NP$.

The third nonequivalent transformation C is as follows:

The Peano axiomatic system is incomplete, and proposition Q is expressed as proposition Q .

Funding: This research received no external funding.

References

1. Nagel E., Newman J.R. Gödel's Proof [M]. Taylor & Francis e-Library, y, 2004: 68-84.
2. Ernest Nagel and James R.Newman. Godel's proof [M]. Tayaylor& Francis e-Library, y, 2004: 87-89.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.