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Rise of the Gole Number System

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Abstract: ***For centuries, the decimal number system served various applications, from basic counting to measuring astronomical distances. However, the efficient and human-friendly representation of extremely large numbers remains a challenge. For instance, the distance between the Earth and the Moon is 384,400,000 meters, demanding nine digits in decimal representation. To address these challenges, this paper introduces a new number system called the Gole Number System. This new number system is based on an extended radix system, allowing for a compact and efficient representation of large numbers. Specifically, the Gole Number System, derived from the RNumber system with base 100, reduces the number of digits needed for large numbers, achieving a 50% reduction in representation length. By leveraging unique symbols, Gole number system provides compact numbers that can optimize digital displays, memory usage, and computational efficiency. It also offers a unique alignment with the decimal number system thus making it more familiar to human cognitive ability to easily comprehend the value of the Gole number. This compactness can translate to greater efficiency in storing and transmitting data. Potential applications of this number system are, data compression, compact displays, efficient indexing, and secure identification systems. This paper also outlines formal conversion steps and arithmetic operations within the Gole number system, establishing a rigorous mathematical framework for computational applications.***

Keywords: ***Number Theory, Data Compression, Compact Number Representation, Optimal Numeric Encoding, Numerical Optimization, Alternative Number Systems, RNumbers, Gole Number System.***

Abbreviations:
RSCII: RNumber Standard Code for Information Interchange

I. INTRODUCTION

Numbers are fundamental to human day-to-day life, pivotal in counting, computations, and data representation. In the digital era, handling and storing vast amounts of data necessitate efficient numerical representation methods. Currently, large datasets are indexed using the decimal system, these datasets are stored in binary format for computational processing but displayed in decimal notation for human readability. The need for efficient numerical representation is more pressing than ever. For instance, the distance between Earth and the Moon is 384,400,000 meters (International Astronomical Union, https://www.iau.org/public/themes/measuring/), requiring nine digits to represent.

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The challenge is to achieve the same level of precision with fewer symbols. The Gole Number System, a base-100 representation, addresses this limitation by compressing large numbers while maintaining human readability and computational accuracy.

II. NUMERICAL REPRESENTATIONS

In the current decimal number system, there are nine unique symbols. After the number nine, representing two-digit numbers requires two symbols 1 and 0 to form 10. As the number expands, additional combinations represent progressively larger values. Several other number systems introduced after decimal often lack intuitive readability for human users.

A. Compact Representation Using Hexadecimal

The Hexadecimal system mitigates lengthy symbol issues to some extent by providing a compact numerical representation. However, this notation can be ambiguous for human interpretation due to its inclusion of alphabetic characters (A-F) [1]. As a result, its usage is primarily limited to computers and programming devices. Converting a number from hexadecimal to decimal is a complex process, as it requires mathematical computations that are challenging for humans to perform manually.

Table-I: Representation of Large Numbers in Hexadecimal Format

Hexadecimal	Decimal
…	…
…	…
75BCD1375BCD13	123456787123456787
75BCD1475BCD14	123456788123456788
75BCD1575BCD15	123456789123456789
…	…

While hexadecimal reduces the length of decimal numbers, it introduces ambiguity, as symbols like 'A' can be confused with alphabetic characters. Another encoding scheme, Base64, also faces similar challenges. This issue is addressed by the Gole Number System, which utilizes a unique non-ASCII character set to maintain clarity. Thus enabling the representation of large numbers using fewer digits while maintaining readability and accuracy.

Limitations of the current number systems:

- Decimal (Base 10): Requires long sequences for large values.
- Hexadecimal (Base 16): Concise but difficult for humans to interpret.
- Base64 Encoding: Optimized for data storage but not for mathematical operations or human readability.

The Gole Number System addresses these limitations by introducing 100 unique symbols, ensuring compact notation while preserving ease of use.

III. THE PROPOSED GOLE NUMBER SYSTEM

A. Concept and RNumber Representation

Each number system comprises a unique set of symbols equal to its base value. For instance, the binary number system consists of two symbols: 0 and 1. Similarly, the hexadecimal system consists of 16 symbols, incorporating the digits 0–9, followed by the alphabetic characters A–F. R Numbers exhibit similar characteristics; however, they employ symbols not included in the ASCII character set [2]. A new character code set RNumber Standard Code for Information Interchange (RSCII) is used. For performing the experiments to show conversion steps Unicode characters are utilized.

The RNumber system, with a base of 100 referred to as the Gole Number system offers enhanced human readability. The objective is to establish a distinct character set, RSCII, which will be further detailed in the next sections. This standard code is introduced alongside the Gole Number system. Therefore, the RSCII character set is recommended, despite Unicode Standard 15.0 being employed for experimental purposes.

The Gole Number System is based on the RNumber System, where each number is represented using a unique set of symbols. Unlike decimal (base-10) and hexadecimal (base-16), Gole numbers operate on base-100, allowing a significantly compact representation.

For example:

- Decimal 6789 requires four symbols (6, 7, 8, 9)
- Gole representation requires only two symbols (e.g., కఎ)

B. RNumber with Base 20

The following table shows the sample symbols that were used in RNumber with base 20 during experiments. All the characters/symbols used in experiments are taken from Unicode Standard-15.0 [3].

Table-II: RNumber Base 20 Numerical Representations

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
0	1	2	3	4	5	6	7	8	9	ॐ	१	२	३	४	५	६	७	८	९

C. Gole Number Character Index

The following unique representation table is used for experiments of conversion steps, the top row is the index of the Gole number in the decimal system, and the bottom row is the symbol of the Gole number. This system enables precise, compact numerical representation without confusion with existing language alphabets [4].

Table-III: Symbols in Gole Number Character Index

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17
0	1	2	3	4	5	6	7	8	9	ॐ	१	२	३	४	५	६	७

18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
८	९	अ	इ	उ	ऋ	ए	क	ख	ग	घ	च	छ	ज	झ	ट	ड	ण

36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
त	थ	द	ध	न	प	भ	म	य	र	ल	व	श	स	ह	ఆ	ఇ	ఈ

54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
ఉ	ఋ	ఊ	ఱ	ఇ	ఔ	ఓ	ఝ	ఠ	ఎ	ఏ	ఓ	ఔ	క	ఖ	గ	చ	జ

72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89
ట	డ	ణ	త	ద	న	ప	బ	య	ర	ఱ	ల	ళ	మ	వ	శ	ష	எ

90	91	92	93	94	95	96	97	98	99								
ஜ	க	ந	ம	ந	ல	ள	ര	ന	卐								

Users can become familiar with the Gole number system within a few days to weeks and quickly associate each symbol with its decimal equivalent. Eventually, they can efficiently convert any decimal number into the Gole number system, optimizing both digital and paper storage.

IV. MATHEMATICAL FRAMEWORK AND CONVERSIONS

A. Compact Representations of Decimal using Gole Number

The following table illustrates the Gole number representation for each decimal number, and it is clearly seen that as the number of digits increases in multiples of two, their respective Gole number representation size is reduced to half.

Table-IV: Gole Numbers for Given Decimal Numbers - Set 1

45	100	120	85	48	69	485	48569	7952	100000	100000000	98548796583572
र	10	13अ	మ	श	గ	4మ	4మగ	బఏ	ॐ00	10000	നఉశളఇणట

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Table-V: Gole Numbers for Given Decimal Numbers - Set 2

49750365	57635654870563	8265487603456	346767075474770	546467657573432000
सಠ3ಓ	ఆఎఆ౬ಠ5ఎ	8ख౬ಶಹತಅ	3लದಎತववಎ	౬ಓಕಓತಡमअ0

B. Decimal Number to Gole Number

A simple and easy step-by-step process can be used to convert a lengthy decimal number to a Gole number and convert it back to decimal.

Let's consider the decimal number 149597870700 and follow the detailed steps that are involved in converting it into its representation in the Gole number system.

The first step is to pair the symbols from right to left order, this is how we identify the position value of each digit in a normal way.

Split the Decimal number into pairs from right to left order as shown below,

14 | 95 | 97 | 87 | 07 | 00

Pairing the digits will result in a range from 00 to 99 and in the next step map the corresponding Gole number for each pair using Table IX. Remembering 99 Gole numbers by index would be not an easy task but at the same time not difficult as well.

Now use the Gole number to Decimal Character Index from Table IX and write the corresponding Gole number for each of the pairs created in the previous step.

Table-VI: Decimal to Gole Number Mapping using Character Index

14	95	97	87	07	00
୪	ல	ര	ಕ	7	0

Now combine the mapped Gole symbols in the same order that becomes the Gole number ୪லരಕ70. This is how a Gole number is generated for a decimal number. As it is seen the process is very straightforward to convert decimal numbers to Gole numbers and prominently no complex calculations are involved, and it can be done simply by mapping the relevant symbols using the Gole to Decimal Character Index.

C. Gole Number to Decimal Number

Now converting this Gole number back to decimal can be in a similar approach as mapping the Gole digit to decimal and writing it down as below using the same Table 9.

Table-VII: Gole to Decimal Number Mapping using Character Index

୪		ல		ര		ಕ		7		0	
1	4	9	5	9	7	8	7	0	7	0	0

Use the same Gole to Decimal Index table and write the decimal number mapped to the Gole number in the same sequence. Combining all of them in the same order gives you a full decimal representation (149597870700) of the Gole number. It is evident that the conversion of Gole numbers to decimal is extremely easy when compared with other base conversions like binary or hexadecimal to decimal.

V. ARITHMETIC OPERATIONS IN THE GOLE NUMBER SYSTEM

All the arithmetic operations in the Gole number system can be performed like the traditional operations that we perform in the decimal number system; the only difference is that the decimal number consists of 10 symbols whereas the Gole number consists of 100 symbols.

A. Addition

Addition in the Gole Number System follows the same principles as in base-10 but with base-100 carryover.

Table-VIII: Additions of Two Gole Numbers

3 + 6 ——— 9	4 + 6 ——— ॐ	5 + 6 ——— १	1卐 + 2 1* ——— 21

Some addition operations performed on Gole numbers along with their decimal counterparts are illustrated below. It is evident that the addition of Gole numbers is quite similar to that of decimal numbers and is straightforward.

Table-IX: Additions of Two Gole Numbers Along with Decimal Counterpart

3 + 6 ——— 9	3 + 6 ——— 9	4 + 6 ——— ॐ	4 + 6 ——— 10	ट + ॡ ——— 卐	33 + 66 ——— 99	1卐 + 2 1* ——— 21	199 + 2 1* ——— 201
Gole	Decimal	Gole	Decimal	Gole	Decimal	Gole	Decimal

VI. APPLICATIONS OF GOLE NUMBER SYSTEM

The Gole Number System can be used in broad applications across various fields:

1. Efficient Data Representation: Reduces storage requirements for large numerical datasets.
2. Digital Displays: Optimizes space utilization on screens and digital boards.
3. Cryptography & Security: Offers a novel way to generate compact yet strong encryption keys.
4. Quantum Computing: Facilitates compact numerical representation, useful in multi-state computational models.

VII. GLIMPSE OF PROPOSED RSCII

As mentioned above, a new standard code set, RSCII (RNumber Standard Character for Information Interchange) is being introduced along with the Gole number. Further details will be published in due course. In this section, we will examine a character and its representation in the new standard code set.

[Fig.1: Decimal number 10 in Gole Number Character Index in RSCII]

This paper aims to introduce the Gole Number system; additional insights regarding RSCII will be elaborated upon in future publications. Patent related to this work is mentioned in the references.

VIII. CONCLUSION

The Gole Number System provides a compact, efficient, and human-readable alternative to decimal and hexadecimal notations. By reducing the number of required digits by approximately 50%, it enhances data storage efficiency and computational performance. Future work includes the development of RSCII, a standardized encoding scheme to support Gole Numbers universally. Future research will explore algorithmic optimizations and hardware implementations to further realize the potential of this concept. It is evident now that the distance between Earth and the Sun using the decimal number system using 12 symbols is now reduced to 6 symbols using the Gole number system.

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The concept of the RNumber system is inspired by the mathematical legacy of Srinivasa Ramanujan, whose contributions to number theory continue to be influential. This research aims to extend mathematical frameworks in his honor.

DECLARATION STATEMENT

I must verify the accuracy of the following information as the article's author.

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Ravi Revelly is a Research Manager at MNC with 15+ years of experience in AI, machine learning, natural language processing, generative AI and engineering. Experience in developing AI solutions for enterprise applications and holds deep expertise in statistical modeling and end-to-end ML deployment. Ravi is currently pursuing a part-time course in Quantum systems at IIIT Hyderabad. He has also published research in cryptography and was a finalist in global AI competitions such as OpenCV AI and AWS DeepRacer. With a passion for innovation, secure systems, and team leadership, he continues to push the boundaries of AI and quantum technologies. Alongside his technical pursuits, Ravi has a growing interest in ancient languages and is currently learning Sanskrit, driven by a fascination with linguistic structure and cultural heritage.