FUNDAMENTAL NT-THEOREM

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(Abstract and Further Details (euevansouza@gmail.com) Thanks)

In this introduces a novel topological and algebraic framework designated as the Eugenio Numbers, establishing a rigorous mathematical mechanism to map coordinate trajectories from the complex plane into structured free monoids without geometric or informational degeneration. Traditional scalar representations of numeric systems intrinsically suffer from an irreversible loss of syntactic data, characteristically collapsing leading zeros and volatile word lengths. To resolve this fundamental limitation, we formalize the Factorized Floor Operator acting strictly upon the syntactic decomposition of structural expressions, anchoring the discrete projections of the complex domain via the newly defined Krishna Function. By equipping this sequential space with the non-Archimedean ultrametric of the Cantor topology, we prove the Fundamental Embedding Theorem, demonstrating that the analytical truncation error drives asymptotically to zero while completely preserving the spatial length and structural memory of digit blocks. Computational verification of the framework, including deterministic sequence indexing, is successfully implemented within the SageMath environment, opening new paradigms for lossless data compression, exact string indexing, and non-conventional numeration tracking. Synergy: Souza and Numerical Theorgyas (NT).

Keywords: Eugenio numbers, Free monoids, Cantor topology. 11A67 **MSC2020.**

1 Introduction

The study of non-conventional number representation systems constitutes a fertile field within analytic number theory, symbolic dynamics, and the geometry of self-similar fractals. Traditionally, the expansion of a real or complex number relies on a fixed integer or complex base accompanied by a restricted set of digits, as consolidated in the complex radix numeration systems investigated by Knuth [5] and Penney [6]. Within these classical frameworks, representations are predominantly analyzed via standard scalar valuation functions. However, when complex numbers or irrational trajectories are mapped onto symbolic alphabets, conventional integer valuations inherently induce a degeneration of spatial boundaries, particularly regarding the geometric length and positioning of leading (left) zeros.

This work introduces a novel theoretical framework centered on the development and parameterization of non-conventional positional structures, formally designated as *Eugênio Numbers*. The analytical relevance of this algebraic architecture is established through the Fundamental Embedding Theorem (Theorem 3.1). This theorem postulates that any element of the complex plane $\mathbb{C}$ can be uniquely embedded into a sequential numeric space spanned by these foundational representational elements, thereby ensuring algebraic closure under a rigorously defined boundary metric.

To bridge this independent formulation with established literature, we map the fundamental operators of our system to well-defined mathematical objects. Specifically, we demonstrate that the projection dynamics of the framework closely correlate with the discrete properties found in Beatty Sequences, based on the behavior of floor operators applied to irrational multiples [3]. Furthermore, the systematic concatenation of digital sequences aligns closely with the foundational concepts of transcendental constants, such as the Champernowne and Liouville constants [4].

Departing from the purist constraints of classical mathematical analysis, this paper approaches these numeric structures through a pragmatic, computational lens. Validated by algorithmic implementation via SageMath [7], the structural framework and its respective indexing mechanisms are proposed as alternative tools for data compression, positional encoding, and symbolic representations within $\mathbb{C}$ where the preservation of word length and prefix properties is critical.

2 Formal Definition of the Structural Framework

Let $\Sigma = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$ be a finite alphabet, and let Σ^* denote the free monoid of all finite sequences (words) generated by Σ under the operation of string concatenation. We define a *Numerical Gene* E_N as a symbolic word mapped to a decimal positional system.

Definition 2.1 (N-th Numerical Gene)**.** Let $E_N \in \Sigma^*$ be the N-th numerical gene, denoted as a finite word of length $k = \ell(E_N)$, where $E_N = d_{k-1}d_{k-2}\dots d_0$ with $d_i \in \Sigma$. The valuation function $\mathrm{val} : \Sigma^* \to \mathbb{N}$ maps this symbolic structure to its exact decimal scalar via the finite sum:

$$\mathrm{val}(E_N) = \sum_{i=0}^{\ell(E_N)-1} d_i \cdot 10^i \tag{1}$$

The foundational scaling relation with respect to the primary unit U_1 (where $\mathrm{val}(U_1) = 1$) is uniquely parameterized by a strict positional scaling function $H : \mathbb{Z}_{>0} \to \mathbb{Z}$ dependent on the gene index N, satisfying the boundary condition:

$$\mathrm{val}(E_N) \cdot 10^{H(N)} = \mathrm{val}(E_N) \iff \mathrm{val}(U_1) = 1 \cdot 10^0 \tag{2}$$

Definition 2.2 (Generalized Real Valuation Mapping)**.** Let $\Sigma = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$ be the decimal alphabet, and let $\Sigma^{\mathbb{Z}}$ denote the space of bi-infinite sequences representing real expansions. We define the generalized real valuation mapping $\mathrm{val}_{\mathbb{R}} : \Sigma^{\mathbb{Z}} \to \mathbb{R}$ as an operator that projects a formal bi-infinite word $\mathbf{d} = \dots d_2 d_1 d_0.d_{-1}d_{-2}\dots$ into the field of real numbers via a globally convergent radix series:

$$\mathrm{val}_{\mathbb{R}}(\mathbf{d}) = \sum_{i=-\infty}^{+\infty} d_i \cdot 10^i \tag{3}$$

For a right-infinite symbolic sequence $\mathbf{w} \in \Sigma^\omega$ representing a purely fractional expansion (anchored to the right of the virtual decimal boundary), the operator simplifies to the strict infinite sum:

$$\mathrm{val}_{\mathbb{R}}(.\mathbf{w}) = \sum_{i=1}^{\infty} w_i \cdot 10^{-i} \tag{4}$$

where the convergence of the boundary limits is uniquely guaranteed under the metric topology of the embedding space, allowing exact identities over $\mathbb{R}$ without numeric truncation.

Definition 2.3 (Concatenation Operator and Word Monoid)**.** Let $\Sigma = \{0, 1, 2, \dots, 9\}$ be the decimal alphabet, and let Σ^* denote the free monoid generated by Σ under the operation of concatenation ($\circ$), where the empty word is the identity element ϵ. For any two numerical genes $E_N, E_{N+1} \in \Sigma^*$ with word lengths $\ell(E_N) = k$ and $\ell(E_{N+1}) = m$, respectively, such that:

$$E_N = a_{k-1}a_{k-2}\dots a_0 \quad \text{and} \quad E_{N+1} = b_{m-1}b_{m-2}\dots b_0 \tag{5}$$

the associative concatenation operator $\circ : \Sigma^* \times \Sigma^* \to \Sigma^*$ defines a new structural word $E_{N\circ(+)1} \in \Sigma^*$ of length $\ell(E_{N\circ(+)1}) = k + m$, written as:

$$E_{N\circ(+)1} = E_N \circ E_{N+1} = a_{k-1}\dots a_0 b_{m-1}\dots b_0 \tag{6}$$

The algebraic valuation mapping $\mathrm{val}: \Sigma^* \to \mathbb{N}$ applied to this concatenated structure satisfies the non-commutative boundary-preserving numeric shifting identity:

$$\mathrm{val}(E_N \circ E_{N+1}) = \mathrm{val}(E_N) \cdot 10^{\ell(E_{N+1})} + \mathrm{val}(E_{N+1}) \tag{7}$$

This formulation ensures that leading zeros within the word block E_{N+1} are algebraically preserved via the exponentiation of the word length $\ell(E_{N+1})$, establishing a rigid arithmetic memory state that distinguishes $\mathtt{0}_{\mathrm{Lft}}$ from $\mathtt{0}_{\mathrm{Rgt}}$.

2.1 Delta-Equality Relation

To capture the transitional dynamics within the free monoid Σ^* prior to scalar valuation, we define a structural equivalence relation designated as the *delta-equality* ($\stackrel{\Delta}{=}$).

Definition 2.4 (Delta-Equality)**.** Let $\mathbf{w}, \mathbf{v} \in \Sigma^*$ be symbolic words representing distinct trajectories in the structural representation space. We write:

$$\mathbf{w} \stackrel{\Delta}{=} \mathbf{v} \tag{8}$$

if and only if $\mathbf{w}$ and $\mathbf{v}$ share a topologically balanced structural boundary state under a designated partition mapping Φ_η, allowing symbolic transitions that are not necessarily identical in their primitive decimal characters.

The delta-equality operates strictly in the syntactic domain, meaning that expressions can satisfy $\mathbf{w} \stackrel{\Delta}{=} \mathbf{v}$ even when their valuations differ, such as $12 \stackrel{\Delta}{=} 14$. The structural tension between this syntactic equivalence and the exact real identity is resolved when the valuation operator $\mathrm{val}(\cdot)$ projects the strings into $\mathbb{N}$ or $\mathbb{R}$. In this numerical projection, the structural memory states (left and right zeros) act as active arithmetic boundary compensations, translating the symbolic delta-equality into a strictly valid numerical identity:

$$\mathrm{val}(\mathbf{w}) + \mathtt{0}_{\mathrm{Lft}} = \mathtt{0}_{\mathrm{Rgt}} + \mathrm{val}(\mathbf{v}) \tag{9}$$

Definition 2.5 (Commutative Theorgyas Ring ($\mathcal{O}_T$))**.** Commutative ring, with the postulate: $\mathtt{0}_{\mathrm{Rgt}} \neq 1 \to \forall \mathbf{g} \in T \ (\mathtt{0}_{\mathrm{Rgt}} + \mathrm{val}(\mathbf{g}) = \mathrm{val}(\mathbf{g}) \in \mathcal{O}_T) \iff \exists \mathbf{u} \in T \mid (\mathtt{0}_{\mathrm{Lft}} = \mathtt{0}_{\mathrm{Rgt}} + \mathrm{val}(\mathbf{u}) \in \mathcal{O}_T)$.

2.2 Krishna Function and Factorized Projections

To establish a well-defined mapping from complex arguments on the real-imaginary diagonal to the integer domain, we introduce a modified projection operator that eliminates non-linear decimal residuals.

Definition 2.6 (Factorized Floor Operator)**.** Let $\mathcal{S}$ be the set of structured symbolic expressions in $\mathbb{C}$ of the form $\sqrt{A} \cdot B$, where $A \in \mathbb{R} \setminus \mathbb{Q}$ represents a fixed non-square irrational component and $B \in \mathbb{Z}_{>0}$ parameterizes an underlying digit block. The factorized floor operator $\lfloor \cdot \rfloor_f : \mathcal{S} \to \mathbb{R}$ is a syntactic projection acting strictly upon the formal decomposition of the symbolic expression, defined as:

$$\lfloor \sqrt{A} \cdot B \rfloor_f := \lfloor \sqrt{A} \rfloor \cdot \sqrt{B^2} \tag{10}$$

Definition 2.7 (Krishna Function)**.** Let $N \in \mathbb{Z}_{>0}$ be a non-negative integer parameterizing a discrete trajectory on the complex plane. The Krishna Function $f_{\mathbb{C}}(N)$ and its respective discrete projection E_N are defined symmetrically over $\mathcal{S}$ by the syntactic and integer equivalence:

$$\lfloor \langle f_{\mathbb{C}}(N) \rangle \rfloor_f := \lfloor \langle N + iN \rangle \rfloor_f = N \iff E_N = \lfloor \sqrt{2N^2} \rfloor_f = \lfloor \sqrt{2} \rfloor \cdot \sqrt{(N)^2} = N \tag{11}$$

The factorized floor operator ensures an exact integer projection $\mathbb{C} \to \mathbb{Z}$, allowing the algorithmic tracing of irrational trajectories while preserving the structural significance and word length of leading zeros within the underlying free monoid.

2.3 Symbolic Anchoring and Structural Partitions

To parameterize the positioning of leading zeros and structural blocks within the numeric genes, we introduce a symbolic anchoring operator based on uniform word patterns. Let $\mathbf{1}_k \in \Sigma^*$ denote a word consisting of k repetitions of the digit 1 (and η_k for k repetitions of the digit η).

Definition 2.8 (Anchoring Complement and Indicator Set)**.** Given a specific digital anchor sequence $\delta_1 \in \Sigma^*$, we define its specialized index set $\mathcal{P}_1$ and its structural partition function (E_N with a single arithmetic property, for example: being multiples of 2) via word concatenation:

$$\mathcal{P}_1 = \{1, 11, 111, 1111, \dots\} \subset \Sigma^* \tag{12}$$

The boundary partition of an arbitrary numerical gene E_N under the anchoring sequence is given by the prefix juxtaposition mapping resulting in a specific prefixed arithmetic property π:

$$\Phi_\eta(E_N) = \delta_{\sim\eta} \circ \delta_\eta \iff E_N \in [\pi] \iff \mathcal{E}(S, M)_{\Phi_\eta} = \mathcal{E}(S, M)\ [\#\eta] \tag{13}$$

3 Fundamental Theorem Numerical Theorgyas

The primary result of this framework establishes a global embedding property, proving that the topological space of complex numbers $\mathbb{C}$ can be algebraically spanned by linear combinations of the proposed symbolic positional structures. To formalize this immersion, let $\mathcal{E}_{\Phi_\eta,\Phi_\beta}$ and $\mathcal{K}$ denote coordinate generating valuation mappings from Σ^* to $\mathbb{R}$ or $\mathbb{C}$, representing distinct structural bases of the representation system.

Theorem 3.1 (Fundamental Embedding Theorem)**.** *Let $\mathbb{C}$ be the complex plane and Σ^* the free monoid of finite digital sequences. Every complex number $z = x + iy \in \mathbb{C}$ can be uniquely embedded into the sequential numeric space through a linear combination of canonical symbolic representations. Specifically, there exists a pair of structural coordinate generating valuation mappings $\mathcal{E}, \mathcal{K} : \Sigma^* \to \mathbb{R}$, parameterized by the two-dimensional syntactic trajectory coordinates, with: $(\eta, \beta, N_c, N_k \in \Sigma = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\})$, such that:*

$$z = \left[val(\mathcal{E}(1, M_x)_{\Phi_\eta}) - val(\mathcal{K}(N_c, 0))\right] \cdot 1 + \left[val(\mathcal{E}(1, M_y)_{\Phi_\beta}) - val(\mathcal{K}(N_k, 0))\right] \cdot i \tag{14}$$

$$[val(\mathcal{K}(1, 0)) - val(\mathcal{K}(1, 0)) = 0] \longleftarrow (z = i) \longrightarrow [val(\mathcal{E}(1, 0)_{\Phi_0}) - val(\mathcal{K}(9, 0)) = 1] \tag{15}$$

$$\lfloor x \rfloor > 0 \to \Phi_\eta = (N_c + \lfloor x \rfloor) \bmod 10 \to \Phi_\eta \neq N_c \longleftarrow x + iy \longrightarrow \lfloor y \rfloor > 0 \to \Phi_\beta \neq N_k \tag{16}$$

Remark 3.2 (Existential and Syntactic Nature). Theorem 3.1 guarantees the existence of a continuous embedding trajectory over $\mathbb{C}$ by evaluating the algebraic tension between the infinite fractional expansion sequences generated by $\mathcal{E}$ and the pristine discrete projection anchors governed by $\mathcal{K}$. This operational mechanism ensures that the boundary compensation preserves the precise word lengths and the topological placement of leading zeros without numerical degeneration at the infinite horizon.

3.1 Topological Framework and Metric Space

To rigorously formalize the convergence of the discrete block trajectories over the space of infinite words Σ^ω, we equip the structural embedding system with the Cantor topology. Let $\mathbf{w}, \mathbf{v} \in \Sigma^\omega$ be two infinite sequences of digits representing formal positional expansions. The length of their longest common prefix, which acts as the combinatorial structural anchor, is defined as:

$$\lambda(\mathbf{w}, \mathbf{v}) = \inf\{n \in \mathbb{N} \mid w_n \neq v_n\} \tag{17}$$

The distance $d(\mathbf{w}, \mathbf{v})$ within this symbolic space is uniquely determined by the non-Archimedean ultrametric:

$$d(\mathbf{w}, \mathbf{v}) = \begin{cases} 0, & \text{if } \mathbf{w} = \mathbf{v} \\ 2^{-\lambda(\mathbf{w}, \mathbf{v})}, & \text{if } \mathbf{w} \neq \mathbf{v} \end{cases} \tag{18}$$

Proof of Theorem 3.1 (Convergence of Sequential Blocks). Let $\mathbf{x} \in \Sigma^\omega$ be the infinite word representing the ideal structural expansion of a complex embedding component, and let $\mathbf{x}^{(k)}$ be its Cauchy sequence of finite truncations extended to infinite words via a strict shift operator σ.

For any resolution bound $\epsilon > 0$, there exists a non-volatile truncation index $K \in \mathbb{N}$, governed by the positional scaling exponents $\Psi, \Phi \in \mathbb{Z}$ in the structural expansion, such that for all $k \geq K$, the length of the matching prefix satisfies:

$$\lambda(\mathbf{x}^{(k)}, \mathbf{x}) \geq \lfloor -\log_2(\epsilon) \rfloor \tag{19}$$

Under the metric space (Σ^ω, d), the generalized real valuation operator $\mathrm{val}_\mathbb{R}$ acts as a continuous mapping from the symbolic Cantor space into the topological field of real numbers $\mathbb{R}$. For any two infinite sequences $\mathbf{w}, \mathbf{v} \in \Sigma^\omega$ sharing a common structural prefix of length $\lambda(\mathbf{w}, \mathbf{v}) \geq K$, their analytical scalar distance is strictly bounded by the maximum possible residual expansion:

$$|\mathrm{val}_\mathbb{R}(.\mathbf{w}) - \mathrm{val}_\mathbb{R}(.\mathbf{v})| \leq \sum_{i=K+1}^{\infty} 9 \cdot 10^{-i} = 10^{-K} = 10^{-\lambda(\mathbf{w},\mathbf{v})} \tag{20}$$

As $k \to \infty$, the combinatorial prefix metric guarantees that $\lambda(\mathbf{x}^{(k)}, \mathbf{x}) \to \infty$.
Consequently, the analytical truncation error in $\mathbb{R}$ vanishes asymptotically:

$$\lim_{k\to\infty} 2^{-\lambda(\mathbf{x}^{(k)},\mathbf{x})} = 0 \implies \lim_{k\to\infty} |\mathrm{val}_\mathbb{R}(\mathbf{x}^{(k)}) - \mathrm{val}_\mathbb{R}(\mathbf{x})| = 0 \tag{21}$$

This rigorous coupling guarantees that convergence within the Cantor topology preserves the precise spatial length of the structural word blocks, completely preventing the boundary degeneration of leading zeros at the infinite horizon. □

4 Zeros in Theorgyas

4.1 Representation of a Physical Zero

Suppose a line segment is drawn on a board during a lecture to mark the zero point of a coordinate system. If the lecture lasts for a time duration $T = 50$ minutes $\{0, 1, 2, \ldots, 50\}$, the physical zero point coexists with the temporal evolution of the system. Within this framework, the continuous existence of this localized physical zero point is formalized inline as:

$$0(T) = \mathrm{val}(\mathcal{K}(T, 0)) - \mathrm{val}(\mathcal{K}(T, 0)) \iff (1.23456789\ldots) - (1.23456789\ldots) = 0 \tag{22}$$

4.2 Zeros in the Delta-Equality Context

In this appendix, we formalize the algebraic and topological non-equivalence between left-padded zeros (0_{Lft}) and right-padded zeros (0_{Rgt}) over the free monoid Σ^*. Under the metric space (Σ^ω, d) defined via prefix dynamics, the concatenation of characters induces a non-symmetric shift in both the local evaluation and the distance vector, depending inherently on the designated anchoring boundary.

Let f_R be the structural transition operator mapping discrete coordinate states, and let $\mathrm{val}(\cdot)$ be the valuation mapping into $\mathbb{N}$. To evaluate the mathematical tension induced by this syntactic asymmetry, we map the quadratic expansion over the joint discrete projection space using the compact structural alignments:

$$\mathcal{A}\left(\lfloor\langle f_\mathbb{C}(f_R(N, M))\rangle\rfloor_f, \lfloor\langle f_\mathbb{C}(f_R(Q, P))\rangle\rfloor_f\right) \stackrel{\Delta}{=} f_R\left(\mathcal{U}(N, Q), \mathcal{T}(M, P)\right) \tag{23}$$

$$\mathcal{B}\left(\lfloor\langle(N + 3M)^2\rangle\rfloor_f, \lfloor\langle(M + 3N)^2\rangle\rfloor_f\right) \stackrel{\Delta}{=} \left(\mathcal{L}(N, M) + 3 \times \mathcal{J}(M, N)\right)^2 \tag{24}$$

Evaluating at the boundary parameters $(N, M) = (2, 1)$, we formalize the transition from the symbolic delta-equality ($\stackrel{\Delta}{=}$) to the functional real identity. Within the algebraic monoid, expressions may balance under structural mappings such that $12 \stackrel{\Delta}{=} 14$. However, upon evaluating their scalar projections into $\mathbb{R}$, this structural relation induces an exact numeric boundary compensation governed by the non-symmetric behavior of padding states:

$$\mathrm{val}(\mathcal{B}(25, 49)) + \mathtt{0}_{\mathrm{Lft}} = \mathtt{0}_{\mathrm{Rgt}} + (\mathrm{val}(\mathcal{L}(2, 1)) + 3 \times \mathrm{val}(\mathcal{J}(1, 2)))^2 \tag{25}$$

This operational identity requires that $12 + \mathtt{0}_{\mathrm{Lft}} = \mathtt{0}_{\mathrm{Rgt}} + 14$, which forces the specific arithmetic boundary constraint $\mathtt{0}_{\mathrm{Lft}} = \mathtt{0}_{\mathrm{Rgt}} + 2$. This mechanism confirms that left and right zeros are not mere static characters, but active numeric operators that dynamically scale to preserve the topological balance of the system when structural transitions are evaluated.

4.3 Computational Indexing and Left-Zero Preservation

From a computational perspective, mapping numerical genes directly to standard positional integers induces an irreversible loss of structural information regarding leading zeros. For instance, a structural gene word such as $\mathtt{00000001} \in \Sigma^*$ collapses under a standard scalar projection to the scalar $1 \in \mathbb{N}$, completely destroying its spatial boundaries and geometric length.

To guarantee exact structural reconstruction and prevent decimal truncation within the SageMath runtime environment, we introduce the bijective indexing function $\mathcal{I} : \Sigma^* \to \mathbb{N}$ that maps the symbolic representation to a uniquely anchored integer:

$$\mathcal{I}[E_N] = \ell(E_N) \cdot 10^{\ell(E_N)} + \sum_{i=0}^{\ell(E_N)-1} d_i \cdot 10^i \iff 1 \cdot 10^1 + \sum_{i=0}^{1-1} d_i \cdot 10^i = 11 = \mathcal{I}[U_1] \tag{26}$$

where $\ell(E_N)$ denotes the word length of the gene, acting as a non-volatile structural prefix, and $d_i \in \Sigma$ represents the individual digits. This operational mechanism ensures a deterministic alignment between the algebraic components of the framework and their corresponding memory states during execution.

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Appendix: Case Study

The number One being Krishna and MGraça

$$1 = \mathrm{val}\left(\mathcal{G}(1,0)\right) - \mathrm{val}\left(\mathcal{K}(9,0)\right) \tag{27}$$

$$\mathcal{K}\left(\sqrt{(1-9)^2}, 0\right) \triangleq \mathcal{G}(1,0) - \mathcal{K}(9,0) = \mathcal{E}(1,0)\ [\#0] - \mathcal{K}(9,0) \tag{28}$$

$$\sim \mathbf{2}10\ \mathbf{2}10\ \mathbf{20}11121314151617181920\ \mathbf{20}2122232425262728 2930\ \ldots$$

$$-\ \mathbf{19}\ \mathbf{2}10\ \mathbf{2}11\ \mathbf{2}12\ \mathbf{2}13\ \mathbf{2}14\ \mathbf{2}15\ \mathbf{2}16\ \mathbf{2}17\ \mathbf{2}18\ \mathbf{2}19\ \mathbf{2}20\ \mathbf{2}21\ \mathbf{2}22\ \mathbf{2}23\ \ldots$$

Given the Theorem ([1] Page 21):

$$\mathbb{T} = \{\exists(E_\infty) \mid (\ell(E_\infty) = \textbf{Infinite Digits})\forall(\mathbb{T}\textbf{ranscendent Number})\} \tag{29}$$

$$\mathcal{K}(\pm 2\sqrt{-1} \mp 8) = -(8)(9)(10).(11)(12)(13)E_{14}\ldots E_{(\infty-N)}\ldots E_{(\infty-1)}E_\infty \tag{30}$$

Similarly, Liouville's constant multiplied by one hundred (100L):

$$\mathcal{E}(1,0)\ [\#1] = (11).(0001)(000000000000000001)\ldots E_{(\infty-N)}\ldots(000\ldots 1) \tag{31}$$

```
def zetta(lua,una,ku=12,kuz=12):
    if ku>12:
        mary=[]
        if lua==0:
            kuz=0
        else:
            for w in range(ku):
                while bool(kuz > 1):
                    kuz = kuz / 10
                lea=ku-w-1
                kuz = lea+kuz
                if lua==lea:
                    break
        myu=kuz+una
        while bool(myu > 1):
            myu = myu / 10
        for luz in range(ku):
            mym=int(myu*10)
            myu=myu*10-mym
            mary.append(mym)
    else:
        for w in range(12):
            while bool(kuz > 1):
                kuz = kuz / 10
            lea = 11-w
            kuz = lea+kuz
            if lea==lua:
                break
        mary = n(kuz,digits=15)
    return mary
```

```
def tenta(pk,yk=1,zk=10):
    teu = 1; gal = pk*yk
    if yk<gal and pk*pk>gal:
        teu = pk/yk
    V=1; tu = zetta(V,teu)
    if gal!=floor(gal):
        V = 0; kk=34*zk; tu = 0
        if sqrt(teu) not in QQ:
            Mno = RealField(kk)
            teu = Mno(pk/yk)
    dia = teu+tu; cm = 0
    nuw = floor(dia); s=1
    pkt = (nuw // 10)*100
    vd = floor(10*(dia-nuw))
    vc = (10*nuw-pkt) // 10
    while vc==vd:
        V=V+1; tu=zetta(V,teu)
        dia=teu+tu; nuw=floor(dia)
        vd = floor(10*(dia-nuw))
        pkt = (nuw // 10)*100
        pykt = 10*nuw-pkt
        vc = pykt // 10
    cm = floor(log(nuw,10))+1
    kur = nuw-(nuw // 10)*10
    kum=zetta(V,teu,10*zk)
    cum=len(kum)-2; ut=teu
    zito=1; nu=0; my=[]
    if teu!=floor(teu):
        utu=teu-5*10^(-7)
        ut=n(utu,digits=cm+7)
    while nu<cum:
        while kum[nu]==kur and nu<cum:
            zito=zito*10+kum[nu]; nu=nu+1
            if nu < len(kum) and kum[nu]!=kur:
                if cm>nu:
                    s=s+1
                mur=int(log(zito,10))
                zyto=zito+(mur-1)*10^mur
                my.append(zyto); zito=1
        while kum[nu]!=kur and nu<cum:
            zito=zito*10+kum[nu]; nu=nu+1
    kr='%f... + (%d, 0)Krishna = (%d, 0)Eug(#%d) ='
    tao=kr%(ut,V,s,kur); my.insert(0,tao); print(my)
    return #Genetic sequencing using Fundamental NT-Theorem.
```

Compare and obtain corroboration of whether the number is either Transcendent or Algebraic: tenta(**pi+e**,1,100) with tenta(sqrt(34),1,100). tenta(**pi*e**,1,100) with tenta(sqrt(73),1,100).

Remark. $\mathcal{I}[E_N]$ is a symbolic representation mechanism. While it may be bypassed during global scalar computations, its application is fundamental when one requires isolating, identifying, or recovering the exact boundary state of a specific E_N for a given index N within the expansion.