Formula 51

Where the 51 symbols and the 18-member class come from

Method record for Jeffery Lyn Huckstead - Cerebral Graphix

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Abstract. Fix radix 1438 and decompose the first 1438 Hangul syllables into leading, vowel, and optional trailing components. A uniform law on complete syllables induces expected conditional information contributions for 51 visible components and a separate END event. The visible components form seven exact classes of sizes $2, 1, 9, 1, 9, 11, 18$. We give closed formulas and an exact chain-rule ledger. Ordinate values do not enter the construction. The earlier choice of radix and script remains a provenance question; no inverse search, compression optimum, or theorem about zeros is established.

1. The declared input

Set $N = 1438$. This is the original tabulated-prefix count, retained as the radix even when the transported file later contains 1,566 records. Digit $d \in \{0, \dots, N-1\}$ is rendered as the syllable at `U+AC00`$+d$. Unicode's canonical Hangul decomposition uses [1]

$$d = ((21L) + V)28 + T, \qquad 0 \le V \le 20, \quad 0 \le T \le 27. \tag{1}$$

For $T = 0$ there is no visible trailing component. We record that branch as END; it is not a 28th visible trailing jamo.

The first N syllables contain three leading components L_0, L_1, L_2, all 21 vowels, and all 27 visible trailing components:

$$\left\lceil \frac{1438}{588} \right\rceil + 21 + 27 = 3 + 21 + 27 = 51, \qquad 588 = 21 \cdot 28. \tag{2}$$

Choose a **complete syllable** uniformly from the inventory. This differs from a file's empirical digit distribution. A component's weight is its expected contribution to the conditional information cost, not a game-selection probability.

If $n(u)$ is the number of inventory syllables compatible with prefix u, define

$$w(c) = \frac{1}{N} \sum_{d:\ c \text{ occurs in } d} \log_2 \frac{n(\text{parent prefix})}{n(\text{child prefix})}. \tag{3}$$

The path is L, then V, then T or END. The product of its conditional probabilities is $1/N$, so each complete path costs $\log_2 N$ bits. Averaging and grouping events proves

$$\boxed{\sum_{c \text{ visible}} w(c) + w(\text{END}) = \log_2 1438.} \tag{4}$$

2. Every weight in seven formulas

The leading blocks have sizes 588,588,262. The last contains nine full vowel contexts of size 28 and one of size 10. Write $\ell(x) = \log_2 x$. The table gives $Nw(c)$; divide by 1438.

Class	Components	Size	Exact $Nw(c)$
1	L_0, L_1	2	$588\ell(1438/588)$
2	L_2	1	$262\ell(1438/262)$
3	$V_0, \ldots, V_8$	9	$56\ell(21) + 28\ell(262/28)$
4	V_9	1	$56\ell(21) + 10\ell(262/10)$
5	$T_1, \ldots, T_9$	9	$51\ell(28) + \ell(10)$
6	$V_{10}, \ldots, V_{20}$	11	$56\ell(21)$
7	$T_{10}, \ldots, T_{27}$	18	$51\ell(28)$

END contributes as much as one class-5 component and remains outside the visible alphabet. Expanding Nw into integer combinations of prime logarithms checks equality by coefficient vectors and order by positive rational products. `derive51.py` verifies the decreasing order exactly and its agreement with the historical sort: decreasing twelve-decimal weight, then code point.

The rounded ledger is

$$10.317040568840 + 0.172807391599 \approx \log_2 1438 \approx 10.489847960439.$$

Only the displayed decimals are approximate; (4) is exact.

Why eighteen, and why lowest

Since $1438 = 51 \cdot 28 + 10$, there are 51 complete leading/vowel contexts and one partial context. Components $T_1, \ldots, T_9$ occur 52 times; $T_{10}, \ldots, T_{27}$ occur 51 times. Their contributions give the 18-member tie; comparison with the other formulas places it last.

These are separate facts. For $N = 28m + r$ with $1 \le r \le 27$, the lower-frequency visible trailing class is $T_r, \ldots, T_{27}$, of size $28 - r$. If $r = 0$, all 27 visible trailing components tie. A remainder does not establish a global minimum. For example, at $N = 1186 = 42 \cdot 28 + 10$,

$$w(L_2) = \frac{10}{1186} \log_2 \frac{1186}{10} \approx 0.0580941 < \frac{42}{1186} \log_2 28 \approx 0.1702436 = w(T_{10}).$$

3. The physical dictionary and the transport

Sort the 51 visible components by the convention above. Assign them in order to card faces ordered by rank A,2,...,K and suits ♠, ♡, ♢, ♣, omitting 2♣. The face address is $q = 4(v - 1) + s$ with suit residues $0, 1, 2, 3$; address 7, 2♣, is the outside marker I. The seven classes occupy canonical identity ranges

$$[1, 2],\ [3, 3],\ [4, 12],\ [13, 13],\ [14, 22],\ [23, 33],\ [34, 51].$$

This bijective physical realization permits relabeling when the decoder, observations, and transitions move with it.

The source codec packs a compressed file into base-1438 digits and components, using `delta32` in the cited implementation. A separate factorial codec transported the 1,566-record file in 301 deck arrangements. One direct-ordinate deck instead carries one scaled integer by its Lehmer rank. A component count or weight profile is not the file payload.

Numerical transport retains an origin, scale, and rounding rule. Odlyzko's high blocks contain offsets; Decimal arithmetic preserves their stated origins. Padding nine places to twelve adds no accuracy and forces divisibility patterns. The high-precision low table has 100 records with over 1,000 decimal places. These conventions affect the transported record; (1)–(4) remain fixed.

4. Counts and provenance

Every integer radix in $[1177, 1764]$ gives 51 visible components under this construction. This is a band of 588 choices, not an isolated property of 1438. Two occurrences of 51 obey

$$\lfloor N/28 \rfloor = 51 \Longrightarrow 1428 \leq N \leq 1455 \Longrightarrow \lceil N/588 \rceil + 21 + 27 = 51.$$

The converse fails at $N = 1177$, which has 51 components and 42 complete contexts. The third occurrence, $52 - 1 = 51$ active cards, comes from the physical realization. The repeated count is not evidence about ordinate values. Nor is it the prefix perplexity, which is approximately 54.23.

The earlier inverse-search account is withdrawn: the retained implementation directly constructs the alphabet from the declared radix, script, and weighting. Why Hangul was chosen and whether other radices were explored remain undocumented.

The retained conversation reports 51 components before Huckstead proposes a physical pack. He supplied the card proposal, null role, suit order modulo four, three hands of seventeen, trade unit, and A=1. The assistant supplied the recorded weighting, address implementation, and transports. The original attribution to the Constructive Reasoning Seat is retained.

5. Reproduction and scope

In `inherited`, run `python3 derive51.py card_alphabet.csv` to regenerate the classes and exact ledger and compare the archived order and weights. `T51_replay.py` checks the fixed-record game. The new `verify_extensions.py` checks the closed-form table and Project's sharper sector bounds.

A game optimization needs its own target, observations, actions, and objective. Project 51 prices a reveal by its decision improvement; that additional objective does not change the alphabet's derivation.

TN Postmaster v5.1 remains frozen. Its reported global source prefix is W_1 through $W_6 > 0$, with the independent W_7 source step open; the present review checks that citation interface, not its certificate machinery. RH remains open.

References and source record

1. Unicode Consortium, *The Unicode Standard*, version 17.0, §3.12, Conjoining Jamo Behavior. Constants and decomposition in (1).
2. *Formula 51*, original method record, 22 September 2026, corrected 23 September 2026, with `derive51.py` and `card_alphabet.csv`. Retained in Zenodo record 22970030. Earlier implementation: `card_lab/cards.py`, `codec.py`, and `CARD_RULE.md` in the v7.2 source archive.
3. J. L. Huckstead, *The Line Game | Surprise Is Not Meaning*, v7.5, record 22943070; *Telescope 51* and *Project 51*, supplied companion manuscripts.
4. A. M. Odlyzko, Tables of zeros of the Riemann zeta function. The review package records hashes of the supplied files and a separate nearest-twelve-place comparison branch.
5. J. L. Huckstead, *TN Postmaster*, Volume I, v5.1, Reading Volume §R12, record 22844194.