

AREA 51 / WORKING PAPER / BETA v0.1

Poker 51

One Card Declared, Five Probabilities Preserved



DECLARED / OUT

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Abstract

Poker 51 is a browser experiment in five-card draw with 2♣ declared outside the deck. Removing that card preserves the exact probabilities of one pair, two pair, three of a kind, full house and four of a kind. A transitive-incidence argument proves the invariance. Exhaustive censuses give the four changes: straight and straight flush probabilities increase by 5.10638% relative to the 52-card values; flush and high card decrease by 0.0399873%. The beta enumerates each possible draw under a stated information model and supplies a fixed House rule. It does not estimate an optimal strategy, a player advantage or a human learning effect.

1. A frozen experiment

The active set is a standard deck without 2♣: 51 distinct identities. The outside marker is I. Poker uses this identity set, freshly shuffled for each hand; it does not retain the Invariant fixture’s card order or decode any stored zero label. Ace is high except in A-2-3-4-5. Suits do not break showdown ties.

Deal and decision order. The player receives five cards, then the House receives five. The player keeps any subset and replaces the rest; the House then draws under the rule below. Discarded cards never return during that hand. The House’s draw count is displayed. The player can show or fold; either action reveals both hands. A fold records a counterfactual showdown comparison, not a saved stake: v0.1 has no wagers or awards.

House rule: first applicable row	Cards kept
Straight or better	All five
Three of a kind / two pair / one pair	All cards in the repeated ranks
Otherwise, four to a flush	Those four
Otherwise, four consecutive ranks, 2-3-4-5 through 10-J-Q-K	Those four; A-2-3-4 and J-Q-K-A do not qualify
Otherwise	The highest card; deterministic suit order ♠ ♥ ♦ ♣ if needed

The House uses its own initial hand only. It does not inspect the player’s cards or stamps. This is a declared deterministic policy, with no optimality claim.

2. Why five probabilities are preserved

Proposition (uniform deletion under transitive incidence). Let E be a class of five-card hands preserved by a permutation group acting transitively on the 52 card identities. If $T = |E|$ and I is the number of its hands containing one specified card, then every card has incidence I . Double-counting card-hand incidences gives $52I = 5T$. Deleting any specified card therefore retains $47T/52$ hands of E .

$$C(51,5) / C(52,5) = 47/52, \text{ so } (T - I) / C(51,5) = T / C(52,5).$$

For each of the five repeated-rank categories, arbitrary rank relabellings and independent suit permutations within each rank preserve the category and act transitively on identities. The proposition applies. It does not apply to the remaining four exclusive poker categories: their definitions depend on rank order, common suit, or exclusions of those events.

Exact census

Exclusive category	52 cards	51 cards	Relative probability change
Straight flush	40	38	+5.10638%
Four of a kind	624	564	0 (exact)
Full house	3,744	3,384	0 (exact)
Flush	5,108	4,615	-0.03999%
Straight	10,200	9,690	+5.10638%
Three of a kind	54,912	49,632	0 (exact)
Two pair	123,552	111,672	0 (exact)
One pair	1,098,240	992,640	0 (exact)
High card	1,302,540	1,176,825	-0.03999%

Denominators: $C(52,5) = 2,598,960$; $C(51,5) = 2,349,060$. Royal flush is included in straight flush. Straight excludes straight flush; flush excludes straight flush; high card excludes both straight and flush. Changes are relative percentages, not percentage points.

The four changed categories. The 2 belongs to two of the ten straight rank sets. For each such set, fixing $2\clubsuit$ leaves $4^4 - 1 = 255$ non-flush suit choices. Thus 510 ordinary straights and two straight flushes disappear: both retain 19/20 of their hands. Their probability ratio is $(19/20)/(47/52) = 247/235$.

The ordinary flush count loses $C(12,4) - 2 = 493$, giving 4,615. For any non-straight five-rank set, non-flush suit assignments are 255 times flush assignments in either deck: 1,020/4 in the full deck or when the 51-card rank set omits the 2, and 765/3 when the 51-card rank set includes the 2. Hence high card equals 255 × flush in both censuses. Their common relative change is exactly -24/60,019. The straight change depends on which rank is removed; the five invariances hold for deletion of any card.

3. What the exact draw panel means

Let H be the player’s initial five-card hand and K a specified subset to keep. Put $k = 5 - |K|$. Before using any stamp observation, the remaining 46 identities are exchangeable from the player’s seat. Although five are physically in the House’s initial hand, those identities are unknown and the House has not acted. Marginalizing that unknown hand makes every k -subset of the 46 equally likely as the player’s replacement set. All five initial player cards remain excluded, including discards. Write U for those 46 unseen identities.

For category j : $P(j \mid H, K) = \#\{D \subset U: |D| = k, \text{category}(K \cup D) = j\} / C(46,k)$.

Cards drawn k	0	1	2	3	4	5
Possible draws	1	46	1,035	15,180	163,185	1,370,754

The engine visits every completion; it does not sample. The panel reports the category of the player’s final hand. “Higher category” excludes improvements within one category, such as a better kicker. It is neither a showdown win probability nor an expected-return calculation.

A replayable example

Start with $K\spadesuit K\heartsuit 7\diamondsuit 4\clubsuit 9\spadesuit$ and keep the kings. There are $C(46,3) = 15,180$ completions. The exact distribution is:

Final category	Completions	Probability
One pair	10,796	71.119895%
Two pair	2,412	15.889328%
Three of a kind	1,772	11.673254%
Full house	156	1.027668%
Four of a kind	44	0.289855%

All other categories have zero completions in this example. The counts sum to 15,180.

Stamps change the information, not the cards

A House card whose stamp was earned in Memory 51 displays that mark on its back. A player who recalls the mapping may infer the identity; the House ignores marks. The odds panel deliberately ignores all stamp observations, including whether a card is marked. It is therefore a baseline, not the full posterior distribution of a player using stamps.

The House’s later draw count is another observation of its fixed policy. A future win-probability model must condition jointly on that policy, the draw order, available marks and unseen discards. Simply maximizing the chance of reaching a higher hand category need not maximize the chance of beating the House. Quantifying the decision value of recall remains an open task for this beta.

4. Verification, limits and next questions

Evidence in this package	Scope
Supplied verifier: 25/25 checks pass	Two evaluators agree on all 2,598,960 standard-deck hands and all 2,349,060 active-deck hands; rule, draw and sampled deal checks pass.
Independent C++ census	Enumerates standard-deck hands and filters out 2♣; reproduces every count above without importing the game engine.
Independent draw and showdown replay: 35/35 checks pass	Every category for all 32 hold masks of the example hand agrees; 200,000 deterministic sampled showdowns agree with a separate full ranking key.

The all-mask draw fixtures contain 2,349,060 completions in total, a partition check: each final five-card set uniquely determines which original cards it retains. This does not exhaust all starting hands. The supplied showdown test checks consistency with the engine’s own key; the added replay independently constructs that key. Sampled showdowns are not an exhaustive strategy proof.

Reproduce from the site root

```
node area-51/poker-51/verify-poker51-v0-1.mjs
node area-51/poker-51/verify-independent-v0-1.mjs
```

The separate C++ source includes its compile/run command and regenerates INDEPENDENT_CENSUS_v0_1.json. Both verifiers write JSON receipts next to the game. The evidence manifest records source hashes. PP288 [3] supplied a corroborating census report; this draft’s numbers are backed by the new local replay, not solely by that report.

Implementation and interpretation limits

The beta uses browser cryptographic random words, rejection sampling for bounded integers and Fisher-Yates shuffling. Uniformity follows under the stated uniform-word model; the censuses do not certify browser entropy. The House hand exists in client memory and can be inspected. This is a research exhibit, not a secure adversarial game.

Poker actions make no jbit wagers or awards and do not alter earned stamps. The existing shared wallet reader can initialize or refresh its normal recovery balance. Poker stores its own record locally, retaining the most recent 500 hand receipts; it exports only when requested. The game is not a controlled study of cognition. No result here concerns zeta zeros or RH.

Open research questions. What policy maximizes showdown success against this exact House rule? When does a decoded stamp change the best hold decision? How much does that decision improvement depend on the House’s observable draw count? Answering these requires a stated objective and a conditioned opponent model; neither an optimal policy nor a quantified memory advantage is claimed.

References and draft citation

[1] Huckstead, Jeffery. Project 51: Reading the Record Across Rules. Zenodo record, 28 September 2026. doi:10.5281/zenodo.23004789. Intended collection destination; this existing DOI does not identify the Poker draft.

[2] Huckstead, Jeffery Lyn / Cerebral Graphix. Poker 51 beta v0.1. Supplied site delta, engine and verifier, 28 September 2026. Game route: cerebralgraphix.com/area-51/poker-51/.

[3] PP288: daily crawler return, 28 September 2026, §C-4. Author-supplied constructive-seat research report, retained under the game’s provenance/ directory. Other PP288 numerical claims are outside this paper’s scope.

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