



## Poker Cards Analysis - March 2019

### The Directors

GVC Plc

This is to confirm that iTech Labs has examined the game logs for Poker games for the period **March 01, 2019** to **March 31, 2019** as recorded by the respective game servers and analyzed the Poker cards for statistical randomness. The results of the analysis are given below.

**URLs:** <https://www.bwin.be/>, <https://www.bwin.dk/>, <https://www.bwin.es/>, <https://www.bwin.fr/>, <https://www.bwin.it/>, <https://www.premiumbull.com/>, <https://www.bwin.gr/>, <https://www.bwin.com/>, <https://www.partypoker.cz/>, <https://da.partypoker.com/>, <https://danskspil.dk/>, <https://www.partypoker.fr/>, <https://www.giocodigitale.it/>, <https://www.br.betboo.com/en>, <https://www.partypremium.com>, <https://www.partypoker.es/en>, <https://www.partypoker.com/>, <https://sports.premium.com/en/sports>, <https://poker.partypoker.se/sv/poker>, <https://sports.sportingbet.com/en/sports>, <https://sports.sportingbet.gr/el/sports>, <https://www.sh.bwin.de/>, <https://sports.vistabet.com/el/sports>, <https://sports.sportingbet.co.za/en/sports>

### 1. Actual and theoretical probabilities for various Poker hands

These calculations were done for Royal Flush, Straight Flush, Four of a Kind, Full House, Flush, Straight, 3 of a Kind, 2 pairs, 1 Pair, High Card. The following table compares the observed proportion of times the various types of hands occurred (**Sample** column). **Probability** column shows the theoretical values. **Lower** and **Upper** are the 95% confidence limits.

#### 1.1 Actual and theoretical probabilities for various Poker hands for 52 cards deck:

Hands	Probability	Lower	Sample	Upper
Royal Flush	0.00003	0.00003	0.00003	0.00003
Straight Flush	0.00028	0.00028	0.00028	0.00028
4 of a kind	0.00168	0.00167	0.00168	0.00169
Full House	0.02596	0.02593	0.02600	0.02599
Flush	0.03025	0.03022	0.03026	0.03029
Straight	0.04619	0.04615	0.04617	0.04624
3 of a kind	0.04830	0.04826	0.04831	0.04834
2 pairs	0.23496	0.23487	0.23496	0.23504
1 pair	0.43823	0.43813	0.43820	0.43832
High Card	0.17412	0.17404	0.17411	0.17420
	1.00000			

Notes:

- In the above table, all observed probabilities (**Sample** column) except one (1) are within the 95% confidence limits.
- The probability of 0.43823 means there are 43,823 chances in 100,000 for getting a pair.

#### 1.2 Actual and theoretical probabilities for various Poker hands for 36 cards deck:

Hands	Probability	Lower	Sample	Upper
Royal Flush	0.00022	0.00019	0.00024	0.00026
Straight Flush	0.00104	0.00097	0.00099	0.00112
4 of a kind	0.00535	0.00517	0.00521	0.00552
Full House	0.07583	0.07521	0.07590	0.07646
Flush	0.02103	0.02069	0.02112	0.02137
Straight	0.13651	0.13570	0.13579	0.13733
3 of a kind	0.07638	0.07575	0.07715	0.07700
2 pairs	0.37820	0.37705	0.37828	0.37934

1 pair	0.27751	0.27645	0.27714	0.27857
High Card	0.02792	0.02753	0.02818	0.02831
	1.00000			

Notes:

- In the above table, all observed probabilities (**Sample** column) except one (1) are within the 95% confidence limits.
- The probability of 0.27751 means there are 27,751 chances in 100,000 for getting a pair.

## 2. Actual and theoretical probabilities for Ranks

The theoretical probabilities for the ranks are shown in the **Probability** column. The **Sample** column shows observed probabilities. **Lower** and **Upper** are the 95% confidence limits.

### 2.1 Actual and theoretical probabilities for Ranks for 52 cards deck:

Rank	Probability	Lower	Sample	Upper
A	0.076923	0.076903	0.076931	0.076943
2	0.076923	0.076903	0.076929	0.076943
3	0.076923	0.076903	0.076915	0.076943
4	0.076923	0.076903	0.076905	0.076943
5	0.076923	0.076903	0.076931	0.076943
6	0.076923	0.076903	0.076937	0.076943
7	0.076923	0.076903	0.076932	0.076943
8	0.076923	0.076903	0.076921	0.076943
9	0.076923	0.076903	0.076909	0.076943
10	0.076923	0.076903	0.076931	0.076943
J	0.076923	0.076903	0.076925	0.076943
Q	0.076923	0.076903	0.076916	0.076943
K	0.076923	0.076903	0.076917	0.076943

Notes:

- In the above table, all observed probabilities (**Sample** column) are within the 95% confidence limits.
- Theoretical probability of 0.07692 means, there are 7,692 chances for any particular rank to occur in 100,000 cards.

### 2.2 Actual and theoretical probabilities for Ranks for 36 cards deck:

Rank	Probability	Lower	Sample	Upper
A	0.111111	0.110830	0.111157	0.111392
6	0.111111	0.110830	0.111313	0.111392
7	0.111111	0.110830	0.111092	0.111392
8	0.111111	0.110830	0.111045	0.111392
9	0.111111	0.110830	0.111150	0.111392
10	0.111111	0.110830	0.110911	0.111392
J	0.111111	0.110830	0.111116	0.111392
Q	0.111111	0.110830	0.111077	0.111392
K	0.111111	0.110830	0.111139	0.111392

Notes:

- In the above table, all observed probabilities (Sample column) are within the 95% confidence limits.
- Theoretical probability of 0.111111 means, there are 1,111 chances for any particular rank to occur in 100,000 cards.

## 3. Actual and theoretical probabilities for Suits

The theoretical probabilities for the suits are shown in the **Probability** column. The **Sample** column shows observed probabilities. **Lower** and **Upper** are the 95% confidence limits.

### 3.1 Actual and theoretical probabilities for Ranks for 52 cards deck:

Suit	Probability	Lower	Sample	Upper
Clubs	0.25000	0.24997	0.24999	0.25003
Diamonds	0.25000	0.24997	0.24999	0.25003
Hearts	0.25000	0.24997	0.25001	0.25003
Spade	0.25000	0.24997	0.25002	0.25003

*Notes:*

- In the above table, all numbers in the **Sample** column (observed probabilities) lie within 95% confidence intervals.
- Theoretical probability of 0.25 means, there are 25 chances for any particular suite to occur in 100 cards.

### 3.2 Actual and theoretical probabilities for Ranks for 36 cards deck:

Suit	Probability	Lower	Sample	Upper
Clubs	0.25000	0.24961	0.25015	0.25039
Diamonds	0.25000	0.24961	0.25004	0.25039
Hearts	0.25000	0.24961	0.24971	0.25039
Spade	0.25000	0.24961	0.25010	0.25039

*Notes:*

- In the above table, all numbers in the **Sample** column (observed probabilities) lie within 95% confidence intervals.
- Theoretical probability of 0.25 means, there are 25 chances for any particular suite to occur in 100 cards.

## Comments on analysis

### ➤ Analysis of 52 cards deck:

In the calculations for 'Actual and theoretical probabilities for various Poker hands', 'Actual and theoretical probabilities for Ranks' and 'Actual and theoretical probabilities for Suits', 1 (one) out of 27 sample values (corresponding to 3.71%) lie inside the 95% confidence limits. It is acceptable for about 5% of the confidence limits to be exceeded.

The above results for Poker (played with 52 card deck) indicate that the RNG is working correctly.

### ➤ Analysis of 36 cards deck:

In the calculations for 'Actual and theoretical probabilities for various Poker hands', 'Actual and theoretical probabilities for Ranks' and 'Actual and theoretical probabilities for Suits', 1 (one) out of 23 sample values (corresponding to 4.35%) lie inside the 95% confidence limits. It is acceptable for about 5% of the confidence limits to be exceeded.

The above results for Poker (played with 36 card deck) indicate that the RNG is working correctly.

## 4. Conclusion

Analysis for 'Odds on various hands', 'Ranks' and 'Suits' for **52 cards deck** and **36 cards deck** indicated statistical randomness.

iTech Labs has done limited sanity checks to verify the integrity of the game logs. iTech Labs also maintains a copy of the game logs for verification purposes. There were a large enough number of game records to give the calculations sufficient statistical power.

We conclude that the Random Number Generator (RNG) is working correctly.

Please click here to see the [Original](#) report.

Signed:



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Date: June 05, 2019

Signed:



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Disclaimer.

While it is not possible to test all possible scenarios in a laboratory environment, iTech Labs has conducted a level of testing appropriate for a component test of this type.

