Poker Cards Analysis – February 2025

The Directors
Entain Plc

This is to confirm that iTech Labs has examined the game logs for Poker games for the period **February 01, 2025,** to **February 28, 2025** as recorded by the respective game servers and analyzed the Poker cards for statistical randomness. The results of the analysis are given below.

For details on the gaming sites serviced by the Entain Plc game servers and used in this audit refer to the List.

1. Poker hand types statistics

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 Poker hand types analysis involved creating subsets of data and conducting Chi-square tests on each subset.

The null hypothesis for the chi-square test is that the observed frequencies of each type of hand matches the theoretical values for a deck that has been shuffled using a perfect random number generator. The p-values observed in these multiple tests are expected to follow a uniform distribution for the range 0.0 to 1.0.

The analysis performs a KS Test (Kolmogorov-Smirnov test) for uniform distribution on the observed p-values, and the combined p-value result of this test is taken as the final result of the Poker hand types statistics tests.

1.1 Poker hand types statistics for 52 cards deck:

Test No.	DOF	ChiSqr	P-Value
1	9	6.19	0.72026
2	9	15.92	0.06864
3	9	2.97	0.96533
4	9	2.80	0.97167
5	9	7.13	0.62382
6	9	6.36	0.70347
7	9	13.87	0.12685
8	9	1.47	0.99735
9	9	7.84	0.55037
10	9	7.27	0.60934
11	9	7.47	0.58791
12	9	11.18	0.26370
13	9	8.80	0.45616
14	9	6.50	0.68878
15	9	14.13	0.11762
16	9	9.17	0.42179
17	9	3.06	0.96177
18	9	11.01	0.27477
19	9	9.71	0.37445
20	9	11.33	0.25403
21	9	9.17	0.42131
22	9	5.73	0.76684
23	9	6.28	0.71156
24	9	13.85	0.12763
25	9	12.47	0.18829
26	9	4.44	0.88046
27	9	5.91	0.74911

28	9	10.41	0.31853
29	9	20.92	0.01299
30	9	16.43	0.05849
31	9	18.16	0.03336
32	9	11.09	0.26932
33	9	7.68	0.56686
34	9	8.46	0.48865
35	9	6.30	0.70921
36	9	11.23	0.26036
37	9	11.70	0.23105
38	9	21.48	0.01069
39	9	3.51	0.94042
40	9	6.63	0.67553
41	9	12.04	0.21091
42	9	8.87	0.44944
43	9	6.22	0.71749
44	9	10.90	0.28272
45	9	6.52	0.68734
46	9	6.24	0.71600
47	9	7.64	0.57092
48	9	8.51	0.48320
49	9	3.52	0.94008
50	9	6.07	0.73312
51	9	28.00	0.00096
52	9	6.66	0.67274
53	9	15.93	0.06844
54	9	5.60	0.77936
55	9	11.85	0.22189
56	9	4.63	0.86522
57	9	8.87	0.44968
58	9	8.77	0.45856
59	9	10.21	0.33357
60	9	5.28	0.80890
61	9	4.65	0.86368
62	9	9.01	0.43601
63	9	5.14	0.82153
64	9	6.62	0.67690
65	9	16.52	0.05677
66	9	2.64	0.97702
67	9	11.50	0.24314
68	9	7.09	0.62771
69	9	8.75	0.46066
70	9	10.27	0.32894
71	9	3.46	0.94303
72	9	9.26	0.41379
73	9	6.64	0.67498
74	9	7.43	0.59210
75	9	6.91	0.64672
76	9	6.76	0.66196
77	9	11.55	0.23994
78	9	11.65	0.23389
79	9	6.98	0.63889
80	9	9.96	0.35378
81	9	4.41	0.88225
82	9	6.35	0.70468
83	9	3.55	0.93845

84	9	17.19	0.04585
85	9	2.08	0.99019
86	9	9.60	0.38362
87	9	11.53	0.24087
88	9	6.93	0.64476
89	9	5.49	0.79007
90	9	12.43	0.19013
91	9	14.26	0.11348
92	9	10.06	0.34576
93	9	13.14	0.15628
94	9	12.75	0.17433
95	9	12.61	0.18086
96	9	9.62	0.38184
97	9	7.58	0.57742
98	9	5.90	0.75023
99	9	10.43	0.31705
100	9	12.33	0.19529
Combined P-value for all tests (Using KS method)			0.96115

Notes:

1) The P-values are observed probabilities from the Chi-Square tests. The last row shows the result of the KS Test performed on the p-values for all Chi-Square tests, where there are sufficient data.

2. Poker rank statistics

The Poker rank analysis aims to establish that the rank of the cards in each position was equally distributed in one of the 13 possible ranks (2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K, A) for a 52 card deck.

The Poker rank analysis involved creating subsets of data and conducting Chi-square tests on each subset. The analysis performs a KS Test (Kolmogorov-Smirnov test) for uniform distribution on the observed p-values, and the combined p-value result of this test is taken as the final result of the Ranks statistics tests.

2.1 Poker rank statistics for 52 cards deck:

Test No.	DOF	ChiSqr	P-Value
1	84	88.44	0.34911
2	84	103.74	0.07105
3	84	90.85	0.28566
4	84	79.63	0.61457
5	84	82.17	0.53627
6	84	88.00	0.36136
7	84	60.80	0.97351
8	84	81.56	0.55502
9	84	83.35	0.49937
10	84	98.80	0.12884
11	84	78.71	0.64263
12	84	87.54	0.37421
13	84	96.09	0.17305
14	84	105.33	0.05769
15	84	68.87	0.88360
16	84	74.84	0.75251
17	84	60.51	0.97517
18	84	71.53	0.83197
19	84	77.52	0.67790
20	84	62.11	0.96487
21	84	75.39	0.73772
22	84	89.98	0.30775
23	84	102.26	0.08561
24	84	97.21	0.15362

25	84	80.66	0.58296
26	84	105.78	0.05434
27	84	76.95	0.69421
28	84	93.91	0.21560
29	84	75.54	0.73376
30	84	83.23	0.50328
31	84	101.40	0.09508
32	84	85.82	0.42440
33	84	85.19	0.44310
34	84	89.39	0.32334
35	84	92.08	0.25599
36	84	87.78	0.36740
37	84	92.35	0.24979
38	84	85.14	0.44469
39	84	101.64	0.09237
40	84	82.47	0.52684
41	84	85.88	0.42246
42	84	88.83	0.33828
43	84	86.02	0.41855
44	84	98.19	0.13801
45	84	82.86	0.51467
46	84	67.92	0.89925
47	84	71.54	0.83188
48	84	93.03	0.23447
49	84	79.04	0.63263
50	84	85.47	0.43467
51	84	69.18	0.87829
52	84	122.57	0.00387
53	84	77.71	0.67228
54	84	76.74	0.70032
55	84	95.51	0.18369
56	84	76.16	0.71660
57	84	62.68	0.96050
58	84	99.63	0.11727
59	84	83.40	0.49798
60	84	74.26	0.76742
61	84	80.40	0.59092
62	84	70.11	0.86099
63	84	84.37	0.46807
64	84	79.16	0.62897
65	84	77.71	0.67239
66	84	78.11	0.66058
67	84	112.98	0.01918
68	84	79.83	0.60859
69	84	67.60	0.90420
70	84	81.65	0.55239
71	84	92.44	0.24786
72	84	73.00	0.79863
73	84	96.28	0.16957
74	84	109.65	0.03164
75	84	106.31	0.05057
76	84	78.59	0.64625
77	84	67.22	0.90987
78	84	85.03	0.44806
79	84	71.59	0.83080
80	84	87.65	0.37116

81	84	75.71	0.72915
82	84	90.68	0.29007
83	84	67.26	0.90933
84	84	58.60	0.98417
85	84	116.07	0.01175
86	84	64.27	0.94617
87	84	69.38	0.87474
88	84	80.61	0.58448
89	84	96.04	0.17395
90	84	81.51	0.55661
91	84	81.54	0.55574
92	84	67.87	0.90015
93	84	71.97	0.82238
94	84	71.80	0.82617
95	84	105.69	0.05496
96	84	87.55	0.37382
97	84	86.83	0.39450
98	84	88.21	0.35546
99	84	82.46	0.52696
100	84	94.92	0.19513
Combined P-value for all tests (Using KS method)			0.99756

Notes:

1) The P-values are observed probabilities from the Chi-Square tests. The last row shows the result of the KS Test performed on the p-values for all Chi-Square tests, where there are sufficient data.

3. Poker suits statistics

The Poker suits analysis aims to verify that that the cards dealt exhibit an equal probability of all 4 suits (Clubs, Diamonds, Hearts and Spades) in all positions.

The Poker suits analysis involved creating subsets of data and conducting Chi-square tests on each subset. The analysis performs a KS Test (Kolmogorov-Smirnov test) for uniform distribution on the observed p-values, and the combined p-value result of this test is taken as the final result of the Suits statistics tests.

3.1 Poker suits statistics for 52 cards deck:

Test No.	Positions	DOF	ChiSqr	P-Value
1	7	21	10.86	0.96544
2	7	21	19.59	0.54745
3	7	21	21.46	0.43143
4	7	21	15.67	0.78770
5	7	21	12.64	0.92087
6	7	21	23.36	0.32533
7	7	21	39.19	0.00932
8	7	21	21.10	0.45282
9	7	21	22.90	0.34941
10	7	21	17.44	0.68397
11	7	21	20.61	0.48324
12	7	21	27.71	0.14858
13	7	21	25.51	0.22587
14	7	21	15.60	0.79177
15	7	21	12.17	0.93500
16	7	21	20.23	0.50690
17	7	21	17.23	0.69721
18	7	21	22.70	0.36021
19	7	21	23.34	0.32589
20	7	21	25.17	0.24004
21	7	21	11.47	0.95281
22	7	21	24.81	0.25555

23	7	21	25.18	0.23957
24	7	21	26.89	0.17462
25	7	21	17.32	0.69166
26	7	21	10.98	0.96315
27	7	21	19.18	0.57338
28	7	21	25.43	0.22888
29	7	21	12.11	0.93661
30	7	21	14.90	0.82776
31	7	21	21.02	0.45788
32	7	21	34.96	0.02854
33	7	21	26.47	0.18898
34	7	21	17.94	0.65255
35	7	21	28.55	0.12518
36	7	21	20.01	0.52037
37	7	21	20.89	0.46568
38	7	21	23.88	0.29909
39	7	21	19.64	0.54413
40	7	21	29.54	0.10169
41	7	21	23.83	0.30128
42	7	21	24.86	0.25328
43	7	21	21.82	0.40976
44	7	21	17.01	0.71054
45	7	21	31.14	0.07129
46	7	21	24.13	0.28683
47	7	21	16.56	0.73750
48	7	21	17.46	0.68278
49	7	21	23.26	0.33008
50	7	21	32.96	0.04667
51	7	21	13.94	0.87220
52	7	21	22.57	0.36760
53	7	21	27.77	0.14675
54	7	21	17.21	0.69828
55	7	21	17.81	0.66127
56	7	21	19.91	0.52702
57	7	21	19.86	0.53041
58	7	21	17.80	0.66165
59	7	21	18.78	0.59942
60	7	21	16.11	0.76317
61	7	21	26.35	0.19341
62	7	21	22.54	0.36898
63	7	21	16.80	0.72290
64	7	21	16.14	0.76180
65	7	21	23.08	0.33973
66	7	21	13.72	0.88127
67	7	21	18.11	0.64174
68	7	21	22.22	0.38665
69	7	21	14.63	0.84121
70	7	21	10.76	0.96726
71	7	21	17.94	0.65255
72	7	21	13.94	0.87208
73	7	21	18.74	0.60188
74	7	21	18.80	0.59766
75	7	21	22.83	0.35306
76	7	21	21.50	0.42863
77	7	21	15.08	0.81910
78	7	21	27.49	0.15514

79	7	21	24.27	0.28024
80	7	21	26.26	0.19663
81	7	21	19.69	0.54068
82	7	21	14.67	0.83908
83	7	21	23.24	0.33128
84	7	21	29.50	0.10260
85	7	21	30.13	0.08947
86	7	21	14.84	0.83066
87	7	21	21.20	0.44665
88	7	21	23.98	0.29423
89	7	21	18.35	0.62689
90	7	21	25.23	0.23743
91	7	21	18.69	0.60520
92	7	21	12.29	0.93156
93	7	21	19.66	0.54261
94	7	21	16.11	0.76361
95	7	21	16.30	0.75272
96	7	21	21.64	0.42055
97	7	21	19.39	0.56020
98	7	21	12.38	0.92881
99	7	21	15.61	0.79103
100	7	21	17.97	0.65112
Combined P-value for all tests (Using KS method)				0.59588

*Not*es:

1) The P-values are observed probabilities from the Chi-Square tests. The last row shows the result of the KS Test performed on the p-values for all Chi-Square tests, where there are sufficient data.

4. Summary of the analysis

4.1 Summary of the analysis of 52 cards deck:

The analysis of 52 cards completes by combining the result of the KS Test performed in the 3 types of analysis (Hand Types, Ranks and Suits) for 52 card decks using the Holm's method and producing a single Combined P -value.

The combined p-value produced using the Holm's method is used as indication for statistical randomness.

Combination of p-values using Holm's Method		
Test	**P-Value**	**P-Adjusted**
Ranks Test	0.99756	1.00000
Suits Test	0.59588	1.00000
Hand Types Test	0.96115	1.00000
Combined P-Value using Holm's Method		1.00000

Notes:

1) The combined p-value of all statistical tests using Holm's Method conducted for 52 card decks is greater than the minimum value of 0.05 which indicates that the randomness of the observed data falls within 95% confidence limits.

The final outcome of the analysis of 52 cards deck indicates that the RNG is working correctly.

4. Conclusion

Analysis of actual data from game logs for 'Hand Types, 'Ranks' and 'Suits' for **52-card decks** indicated statistical randomness. Since there is no data in the case of 36 card deck, this report does not contain the details of 36 card deck.

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:	**Signed:**
	
Alvin Rizaldi **Chief Executive Officer** **iTech Labs** Date: 18 March 2025	**Divya Bhargava** **Project Manager** **iTech Labs** Date: 18 March 2025

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.