



Blackjack Cards Analysis – Aug 2025

The Directors

Entain Plc

This confirms that iTech Labs has examined the game logs for blackjack games from **Aug 1, 2025, to Aug 31, 2025**, as recorded by the respective game servers. The game logs were for blackjack games using 8 decks. iTech Labs analysed the blackjack 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. Blackjack hand value

Blackjack hand value analysis involved creating subsets of data and conducting Chi-square tests on each subset. Opening hands are the value of the first two cards dealt. Final hand value is the hand value at the end of the game. The dealer's final hand value is based on the fixed rules of the game. The player's final hand value is dependent on the player's strategy choice, so it has no theoretical basis for comparison.

The null hypothesis for the chi-square test is that the observed frequencies of each type of hand match 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 blackjack opening hand value statistics tests.

1.1 Player's opening score (from first two cards):

Test No.	DOF	ChiSqr	P-Value
1	17	17.79	0.40226
2	17	8.28	0.96028
3	17	22.13	0.17962
4	17	14.98	0.59699
5	17	14.47	0.63349
6	17	16.43	0.49334
7	17	11.83	0.81010
8	17	23.07	0.14683
9	17	9.45	0.92493
10	17	24.82	0.09885
11	17	10.87	0.86316
12	17	14.96	0.59833
13	17	10.33	0.88923
14	17	14.59	0.62493
15	17	18.63	0.34989
16	17	18.88	0.33572
17	17	12.87	0.74462
18	17	12.86	0.74542
19	17	15.24	0.57835
20	17	10.72	0.87055
21	17	20.86	0.23261
22	17	18.02	0.38767
23	17	13.72	0.68696
24	17	37.18	0.00318
25	17	18.35	0.36692

26	17	17.24	0.43856
27	17	20.57	0.24597
28	17	16.82	0.46691
29	17	11.38	0.83600
30	17	25.31	0.08796
31	17	5.08	0.99754
32	17	21.35	0.21117
33	17	8.34	0.95879
34	17	21.81	0.19219
35	17	18.15	0.37914
36	17	18.92	0.33331
37	17	17.92	0.39386
38	17	14.02	0.66544
39	17	16.18	0.51111
40	17	10.79	0.86748
41	17	15.76	0.54059
42	17	18.07	0.38463
43	17	21.08	0.22252
44	17	9.78	0.91258
45	17	21.27	0.21453
46	17	14.66	0.61961
47	17	13.00	0.73607
48	17	17.35	0.43065
49	17	17.53	0.41923
50	17	14.38	0.63974
51	17	10.15	0.89700
52	17	29.51	0.03007
53	17	19.69	0.29019
54	17	16.16	0.51227
55	17	18.96	0.33084
56	17	11.95	0.80333
57	17	11.91	0.80554
58	17	27.47	0.05153
59	17	9.35	0.92854
60	17	13.00	0.73636
61	17	10.64	0.87468
62	17	15.59	0.55298
63	17	18.97	0.33019
64	17	31.68	0.01649
65	17	30.06	0.02590
66	17	19.10	0.32310
67	17	16.78	0.46944
68	17	11.32	0.83952
69	17	16.41	0.49517
70	17	35.80	0.00487
71	17	13.94	0.67164
72	17	20.30	0.25897
73	17	10.77	0.86845
74	17	8.95	0.94171
75	17	20.50	0.24956
76	17	18.91	0.33396
77	17	15.16	0.58430
78	17	6.42	0.98990
79	17	16.77	0.47033
80	17	21.69	0.19707
81	17	29.66	0.02893
82	17	22.04	0.18335

83	17	19.11	0.32219
84	17	13.87	0.67644
85	17	12.22	0.78671
86	17	16.74	0.47186
87	17	27.11	0.05645
88	17	21.53	0.20338
89	17	11.87	0.80810
90	17	14.59	0.62489
91	17	27.93	0.04579
92	17	14.43	0.63662
93	17	13.63	0.69307
94	17	17.26	0.43697
95	17	10.49	0.88169
96	17	11.38	0.83632
97	17	12.15	0.79128
98	17	23.82	0.12438
99	17	8.53	0.95394
100	17	12.96	0.73860
Combined P-Value for 100 tests (Using KS method)			0.82217

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 is sufficient data.

1.2 Dealer's opening score (from first two cards):

Test No.	DOF	ChiSqr	P-Value
1	17	4.93	0.99797
2	17	10.59	0.87728
3	17	12.36	0.77782
4	17	14.56	0.62724
5	17	17.94	0.39266
6	17	22.95	0.15089
7	17	16.13	0.51494
8	17	19.25	0.31428
9	17	23.56	0.13179
10	17	19.60	0.29546
11	17	24.99	0.09491
12	17	19.70	0.28981
13	17	13.24	0.71986
14	17	23.72	0.12723
15	17	14.65	0.62054
16	17	18.37	0.36604
17	17	21.65	0.19837
18	17	19.74	0.28753
19	17	14.23	0.65059
20	17	16.86	0.46378
21	17	9.79	0.91236
22	17	16.44	0.49315
23	17	19.54	0.29866
24	17	18.98	0.32944
25	17	24.90	0.09699
26	17	26.59	0.06443
27	17	23.62	0.13017
28	17	11.65	0.82095

29	17	12.01	0.79947
30	17	20.82	0.23436
31	17	14.45	0.63505
32	17	15.48	0.56117
33	17	16.54	0.48587
34	17	15.93	0.52896
35	17	22.57	0.16386
36	17	13.82	0.67986
37	17	22.69	0.15950
38	17	29.11	0.03351
39	17	19.71	0.28956
40	17	10.71	0.87142
41	17	21.97	0.18597
42	17	11.36	0.83701
43	17	19.04	0.32606
44	17	8.84	0.94500
45	17	11.02	0.85566
46	17	24.60	0.10402
47	17	19.41	0.30552
48	17	23.22	0.14211
49	17	20.07	0.27051
50	17	13.53	0.70028
51	17	13.03	0.73450
52	17	17.34	0.43168
53	17	18.46	0.36014
54	17	9.21	0.93335
55	17	17.44	0.42489
56	17	11.70	0.81770
57	17	26.11	0.07248
58	17	11.60	0.82372
59	17	15.63	0.55019
60	17	13.81	0.68068
61	17	21.25	0.21535
62	17	24.26	0.11263
63	17	27.46	0.05168
64	17	9.36	0.92837
65	17	7.18	0.98104
66	17	16.85	0.46450
67	17	12.43	0.77360
68	17	15.76	0.54065
69	17	4.44	0.99896
70	17	17.19	0.44144
71	17	16.38	0.49714
72	17	14.01	0.66658
73	17	29.62	0.02918
74	17	20.12	0.26808
75	17	16.73	0.47310
76	17	18.76	0.34225
77	17	20.47	0.25107
78	17	11.33	0.83908
79	17	10.57	0.87807
80	17	11.76	0.81440
81	17	19.40	0.30582
82	17	12.91	0.74202
83	17	11.39	0.83543
84	17	10.28	0.89127
85	17	18.15	0.37916

86	17	20.27	0.26067
87	17	12.57	0.76425
88	17	15.00	0.59531
89	17	14.98	0.59677
90	17	22.13	0.17981
91	17	28.84	0.03599
92	17	17.14	0.44520
93	17	13.48	0.70339
94	17	8.36	0.95827
95	17	9.03	0.93921
96	17	9.66	0.91736
97	17	18.11	0.38171
98	17	16.75	0.47127
99	17	17.62	0.41310
100	17	17.46	0.42367
Combined P-Value for 100 tests (Using KS method)			0.99168

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 is sufficient data.

1.3 Dealer's final score (total of all cards for hands with 3 or more cards):

Test No.	DOF	ChiSqr	P-Value
1	50	51.86	0.40120
2	50	47.90	0.55821
3	50	36.61	0.92119
4	50	43.01	0.74778
5	50	44.23	0.70297
6	50	32.07	0.97718
7	50	61.72	0.12372
8	50	40.31	0.83432
9	50	46.40	0.61879
10	50	44.03	0.71060
11	50	52.01	0.39560
12	50	40.00	0.84325
13	50	47.68	0.56691
14	50	42.31	0.77170
15	50	45.05	0.67178
16	50	41.22	0.80733
17	50	41.10	0.81080
18	50	50.01	0.47315
19	50	56.61	0.24207
20	50	43.00	0.74798
21	50	35.23	0.94363
22	50	50.02	0.47263
23	50	50.71	0.44536
24	50	69.30	0.03664
25	50	41.94	0.78426
26	50	58.03	0.20330
27	50	58.25	0.19790
28	50	35.66	0.93712
29	50	60.55	0.14590
30	50	58.16	0.20004
31	50	46.94	0.59708

32	50	36.57	0.92194
33	50	46.95	0.59645
34	50	49.46	0.49492
35	50	47.37	0.57935
36	50	50.93	0.43698
37	50	62.60	0.10883
38	50	45.30	0.66233
39	50	49.00	0.51353
40	50	49.71	0.48505
41	50	58.52	0.19107
42	50	42.72	0.75766
43	50	61.47	0.12820
44	50	39.05	0.86845
45	50	55.01	0.29059
46	50	63.11	0.10092
47	50	47.99	0.55432
48	50	52.14	0.39066
49	50	62.01	0.11856
50	50	40.27	0.83554
51	50	48.45	0.53556
52	50	77.15	0.00816
53	50	45.36	0.65989
54	50	53.74	0.33307
55	50	54.80	0.29735
56	50	39.30	0.86193
57	50	65.62	0.06824
58	50	44.71	0.68475
59	50	50.01	0.47287
60	50	39.73	0.85070
61	50	62.34	0.11310
62	50	49.51	0.49304
63	50	51.34	0.42107
64	50	56.35	0.24952
65	50	59.95	0.15827
66	50	44.93	0.67648
67	50	48.89	0.51787
68	50	46.19	0.62705
69	50	60.22	0.15256
70	50	64.05	0.08749
71	50	37.43	0.90546
72	50	67.30	0.05177
73	50	51.53	0.41375
74	50	70.73	0.02835
75	50	49.20	0.50562
76	50	49.28	0.50230
77	50	49.41	0.49691
78	50	54.24	0.31611
79	50	68.98	0.03878
80	50	48.11	0.54962
81	50	44.11	0.70780
82	50	46.65	0.60847
83	50	70.10	0.03179
84	50	40.73	0.82228
85	50	66.23	0.06187
86	50	45.57	0.65171
87	50	37.51	0.90381
88	50	62.43	0.11159

89	50	41.47	0.79944
90	50	40.40	0.83185
91	50	50.26	0.46319
92	50	61.32	0.13103
93	50	39.67	0.85228
94	50	36.18	0.92868
95	50	59.01	0.17938
96	50	35.83	0.93450
97	50	50.64	0.44820
98	50	46.39	0.61908
99	50	52.27	0.38602
100	50	57.69	0.21231
Combined P-Value for 100 tests (Using KS method)			0.76221

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 is sufficient data.

2. Blackjack rank statistics

The blackjack rank analysis aims to establish that the rank of the cards to player and dealer was equally distributed in one of the 13 possible ranks (2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K, A).

The blackjack 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 Blackjack rank statistics for all player cards:

Test No.	DOF	ChiSqr	P-Value
1	12	14.51	0.26930
2	12	10.95	0.53314
3	12	14.79	0.25292
4	12	22.00	0.03749
5	12	11.44	0.49167
6	12	9.64	0.64729
7	12	11.48	0.48863
8	12	12.35	0.41774
9	12	13.86	0.30946
10	12	9.57	0.65358
11	12	4.02	0.98316
12	12	7.68	0.80945
13	12	9.44	0.66524
14	12	17.25	0.14056
15	12	13.82	0.31223
16	12	8.92	0.70983
17	12	8.62	0.73515
18	12	12.45	0.41038
19	12	5.97	0.91774
20	12	5.56	0.93650
21	12	20.27	0.06219
22	12	10.45	0.57693
23	12	16.13	0.18522
24	12	18.15	0.11111
25	12	16.70	0.16132
26	12	14.66	0.26045
27	12	8.60	0.73699

28	12	16.89	0.15384
29	12	13.29	0.34803
30	12	15.53	0.21354
31	12	9.43	0.66619
32	12	9.91	0.62401
33	12	6.09	0.91130
34	12	15.03	0.23986
35	12	17.10	0.14579
36	12	17.14	0.14444
37	12	4.68	0.96774
38	12	5.34	0.94581
39	12	5.53	0.93774
40	12	8.10	0.77740
41	12	12.16	0.43273
42	12	5.93	0.91941
43	12	16.40	0.17349
44	12	9.58	0.65297
45	12	12.58	0.40036
46	12	7.19	0.84512
47	12	12.82	0.38192
48	12	9.73	0.63990
49	12	3.89	0.98527
50	12	9.52	0.65789
51	12	7.07	0.85310
52	12	20.62	0.05620
53	12	14.58	0.26536
54	12	10.59	0.56421
55	12	6.72	0.87552
56	12	8.69	0.72935
57	12	5.48	0.93981
58	12	18.13	0.11173
59	12	5.21	0.95061
60	12	14.95	0.24406
61	12	14.28	0.28315
62	12	3.67	0.98874
63	12	16.05	0.18879
64	12	14.25	0.28483
65	12	7.49	0.82369
66	12	11.00	0.52877
67	12	13.53	0.33141
68	12	6.31	0.89969
69	12	13.16	0.35759
70	12	18.01	0.11551
71	12	10.79	0.54736
72	12	17.15	0.14391
73	12	11.58	0.47977
74	12	9.62	0.64969
75	12	8.12	0.77562
76	12	10.73	0.55199
77	12	14.36	0.27805
78	12	9.26	0.68085
79	12	15.53	0.21365
80	12	11.34	0.49993
81	12	16.64	0.16353
82	12	11.50	0.48674
83	12	9.35	0.67247
84	12	21.38	0.04513

85	12	10.75	0.55067
86	12	9.37	0.67134
87	12	18.66	0.09720
88	12	16.17	0.18367
89	12	11.05	0.52432
90	12	11.76	0.46484
91	12	19.33	0.08089
92	12	18.87	0.09169
93	12	17.18	0.14304
94	12	10.08	0.60861
95	12	9.48	0.66141
96	12	9.44	0.66538
97	12	14.39	0.27678
98	12	7.35	0.83379
99	12	10.87	0.54038
100	12	5.14	0.95316
Combined P-Value for 100 tests (Using KS method)			0.96525

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 is sufficient data.

2.2 Blackjack rank statistics for all dealer cards:

Test No.	DOF	ChiSqr	P-Value
1	12	13.35	0.34396
2	12	12.20	0.43003
3	12	15.61	0.20954
4	12	9.92	0.62268
5	12	14.56	0.26632
6	12	14.48	0.27124
7	12	8.55	0.74095
8	12	5.76	0.92788
9	12	13.02	0.36794
10	12	13.04	0.36643
11	12	15.38	0.22114
12	12	5.01	0.95764
13	12	16.03	0.18975
14	12	10.22	0.59656
15	12	11.53	0.48405
16	12	15.54	0.21300
17	12	7.79	0.80121
18	12	11.41	0.49379
19	12	13.51	0.33340
20	12	6.48	0.89018
21	12	16.16	0.18393
22	12	10.61	0.56237
23	12	14.00	0.30093
24	12	17.10	0.14587
25	12	16.13	0.18539
26	12	21.20	0.04759
27	12	10.76	0.54928
28	12	21.24	0.04695
29	12	6.26	0.90239
30	12	2.60	0.99776
31	12	14.76	0.25482

32	12	11.87	0.45614
33	12	8.20	0.76955
34	12	6.72	0.87549
35	12	19.41	0.07921
36	12	20.68	0.05530
37	12	12.28	0.42319
38	12	8.31	0.76035
39	12	9.37	0.67118
40	12	4.99	0.95838
41	12	7.55	0.81897
42	12	9.70	0.64248
43	12	11.81	0.46068
44	12	17.90	0.11862
45	12	7.66	0.81106
46	12	6.69	0.87746
47	12	14.82	0.25133
48	12	6.35	0.89753
49	12	4.83	0.96341
50	12	13.71	0.31928
51	12	6.09	0.91150
52	12	9.74	0.63890
53	12	15.66	0.20729
54	12	7.49	0.82330
55	12	26.26	0.00985
56	12	10.76	0.54986
57	12	7.32	0.83605
58	12	7.66	0.81117
59	12	12.31	0.42128
60	12	14.05	0.29777
61	12	8.62	0.73490
62	12	6.94	0.86136
63	12	17.53	0.13057
64	12	8.13	0.77524
65	12	15.77	0.20219
66	12	5.36	0.94477
67	12	14.34	0.27932
68	12	10.74	0.55108
69	12	13.50	0.33355
70	12	9.69	0.64339
71	12	4.90	0.96123
72	12	8.26	0.76461
73	12	10.78	0.54781
74	12	8.10	0.77759
75	12	10.66	0.55849
76	12	16.96	0.15103
77	12	16.30	0.17804
78	12	14.23	0.28619
79	12	14.84	0.25024
80	12	12.34	0.41849
81	12	19.68	0.07343
82	12	16.27	0.17939
83	12	10.07	0.61011
84	12	9.39	0.66905
85	12	4.00	0.98337
86	12	16.41	0.17320
87	12	5.13	0.95358
88	12	8.41	0.75268

89	12	10.42	0.57933
90	12	6.27	0.90207
91	12	9.85	0.62876
92	12	16.31	0.17729
93	12	16.40	0.17340
94	12	4.71	0.96688
95	12	9.43	0.66626
96	12	12.63	0.39664
97	12	21.08	0.04927
98	12	16.09	0.18706
99	12	10.28	0.59171
100	12	9.52	0.65818
Combined P-Value for 100 tests (Using KS method)			0.80687

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 is sufficient data.

4. Summary of the analysis of blackjack tests

The Blackjack cards analysis is completed by combining the result of the KS Test performed in the two types of analysis (Hand Values and Ranks) for using Holm's method and producing a single Combined P-value.

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

Combination of p-values using Holm's Method		
Test	P-Value	P-Adjusted
Opening Score (Player)	0.82217	1.00000
Opening Score (Dealer)	0.99168	1.00000
Dealer's Final Score	0.76221	1.00000
Player Cards Rank	0.96525	1.00000
Dealer Cards Rank	0.80687	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 blackjack 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 blackjack indicates that the RNG is working correctly.

5. Conclusion

Analysis of actual data from game logs for 'player opening score', 'dealer opening score', 'dealer final score', 'player card rank' and 'dealer card rank' indicated statistical randomness. The results were satisfactory for 8 decks blackjack.

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

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.

The scope of the review did not include reviews of financial controls or casino operations. We believe that the probabilities were calculated correctly from the game logs.

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

Signed:



Divya Bhargava
Project Manager
iTech Labs

Date: 24 September 2025

Signed:



Alvin Rizaldi
Chief Executive Officer
iTech Labs

Date: 24 September 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.