



Blackjack Cards Analysis – July 2025

The Directors

Entain Plc

This confirms that iTech Labs has examined the game logs for blackjack games from **July 1, 2025, to July 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	10.44	0.88422
2	17	14.11	0.65897
3	17	15.82	0.53698
4	17	14.22	0.65117
5	17	22.32	0.17286
6	17	23.42	0.13600
7	17	21.53	0.20364
8	17	26.60	0.06423
9	17	11.73	0.81619
10	17	20.32	0.25835
11	17	17.91	0.39484
12	17	6.26	0.99127
13	17	16.33	0.50036
14	17	9.46	0.92472
15	17	8.39	0.95748
16	17	11.12	0.85051
17	17	20.97	0.22743
18	17	10.89	0.86226
19	17	15.68	0.54676
20	17	19.28	0.31277
21	17	14.09	0.66090
22	17	16.79	0.46902
23	17	18.54	0.35562
24	17	25.76	0.07898
25	17	15.33	0.57160

26	17	18.62	0.35065
27	17	12.79	0.75042
28	17	19.64	0.29324
29	17	26.11	0.07250
30	17	12.05	0.79722
31	17	18.48	0.35914
32	17	14.18	0.65420
33	17	15.73	0.54283
34	17	24.48	0.10689
35	17	16.21	0.50910
36	17	16.16	0.51284
37	17	27.00	0.05812
38	17	23.59	0.13095
39	17	18.94	0.33214
40	17	23.13	0.14520
41	17	27.53	0.05079
42	17	19.19	0.31772
43	17	12.27	0.78347
44	17	13.74	0.68517
45	17	18.00	0.38885
46	17	23.33	0.13885
47	17	18.99	0.32931
48	17	13.62	0.69405
49	17	18.29	0.37050
50	17	8.70	0.94912
51	17	13.53	0.70018
52	17	11.81	0.81148
53	17	12.05	0.79738
54	17	9.61	0.91913
55	17	17.69	0.40839
56	17	10.47	0.88252
57	17	8.15	0.96331
58	17	17.74	0.40557
59	17	17.92	0.39360
60	17	21.63	0.19924
61	17	13.69	0.68886
62	17	23.17	0.14386
63	17	19.78	0.28542
64	17	23.14	0.14481
65	17	12.81	0.74892
66	17	17.30	0.43397
67	17	10.19	0.89554
68	17	21.45	0.20688
69	17	18.79	0.34049
70	17	16.01	0.52325
71	17	14.64	0.62170
72	17	14.96	0.59842
73	17	16.18	0.51097
74	17	13.99	0.66760
75	17	17.94	0.39237
76	17	14.96	0.59864
77	17	14.25	0.64947
78	17	12.30	0.78162
79	17	12.11	0.79313
80	17	25.92	0.07585
81	17	15.43	0.56453
82	17	15.34	0.57089

83	17	13.60	0.69491
84	17	19.63	0.29371
85	17	13.75	0.68504
86	17	25.64	0.08129
87	17	22.45	0.16793
88	17	15.37	0.56915
89	17	18.72	0.34478
90	17	15.42	0.56554
91	17	14.88	0.60379
92	17	11.09	0.85206
93	17	22.47	0.16720
94	17	11.70	0.81817
95	17	18.36	0.36646
96	17	10.57	0.87807
97	17	12.68	0.75712
98	17	12.15	0.79093
99	17	13.02	0.73474
100	17	13.15	0.72615
Combined P-Value for 100 tests (Using KS method)			0.77190

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	19.77	0.28593
2	17	17.56	0.41726
3	17	13.09	0.73010
4	17	19.15	0.31991
5	17	11.84	0.80969
6	17	31.41	0.01778
7	17	12.69	0.75652
8	17	15.74	0.54262
9	17	12.87	0.74510
10	17	12.43	0.77315
11	17	22.59	0.16292
12	17	14.04	0.66443
13	17	12.81	0.74859
14	17	16.17	0.51182
15	17	16.24	0.50678
16	17	16.45	0.49224
17	17	7.55	0.97521
18	17	8.26	0.96063
19	17	8.65	0.95062
20	17	17.46	0.42397
21	17	9.37	0.92800
22	17	16.02	0.52232
23	17	23.25	0.14117
24	17	11.17	0.84742
25	17	19.40	0.30616
26	17	21.51	0.20420
27	17	10.92	0.86076
28	17	15.67	0.54747

29	17	8.11	0.96415
30	17	24.74	0.10058
31	17	20.24	0.26238
32	17	16.16	0.51257
33	17	17.20	0.44107
34	17	17.74	0.40519
35	17	17.57	0.41634
36	17	17.66	0.41058
37	17	14.52	0.63005
38	17	15.47	0.56173
39	17	16.77	0.47000
40	17	18.00	0.38902
41	17	11.08	0.85246
42	17	9.95	0.90579
43	17	14.64	0.62106
44	17	19.57	0.29685
45	17	6.92	0.98461
46	17	11.40	0.83494
47	17	13.21	0.72170
48	17	14.71	0.61601
49	17	12.97	0.73813
50	17	19.81	0.28411
51	17	11.29	0.84107
52	17	12.74	0.75345
53	17	17.40	0.42756
54	17	21.12	0.22111
55	17	33.95	0.00851
56	17	23.01	0.14882
57	17	10.75	0.86904
58	17	24.18	0.11461
59	17	21.99	0.18502
60	17	10.88	0.86279
61	17	44.87	0.00025
62	17	23.71	0.12761
63	17	27.10	0.05660
64	17	32.32	0.01374
65	17	10.95	0.85898
66	17	16.95	0.45754
67	17	16.94	0.45811
68	17	13.96	0.66978
69	17	22.63	0.16164
70	17	23.87	0.12298
71	17	19.82	0.28341
72	17	20.62	0.24357
73	17	14.31	0.64512
74	17	18.14	0.37996
75	17	22.15	0.17893
76	17	12.77	0.75155
77	17	16.82	0.46652
78	17	18.50	0.35825
79	17	17.73	0.40618
80	17	15.84	0.53486
81	17	10.28	0.89141
82	17	26.64	0.06364
83	17	10.89	0.86200
84	17	9.57	0.92064
85	17	9.52	0.92262

86	17	13.74	0.68554
87	17	16.49	0.48918
88	17	15.57	0.55427
89	17	23.73	0.12685
90	17	24.49	0.10681
91	17	18.28	0.37163
92	17	18.53	0.35598
93	17	12.27	0.78349
94	17	14.94	0.59957
95	17	19.34	0.30945
96	17	13.32	0.71435
97	17	16.76	0.47041
98	17	20.53	0.24813
99	17	12.15	0.79068
100	17	20.85	0.23297
Combined P-Value for 100 tests (Using KS method)			0.98172

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	30.54	0.98642
2	50	55.38	0.27906
3	50	44.87	0.67885
4	50	54.68	0.30156
5	50	47.34	0.58065
6	50	43.22	0.74018
7	50	33.57	0.96406
8	50	52.12	0.39147
9	50	66.76	0.05668
10	50	61.55	0.12676
11	50	35.13	0.94502
12	50	47.81	0.56173
13	50	45.13	0.66871
14	50	39.06	0.86815
15	50	40.81	0.81984
16	50	67.87	0.04702
17	50	47.54	0.57267
18	50	51.31	0.42213
19	50	47.37	0.57972
20	50	52.45	0.37910
21	50	68.62	0.04133
22	50	39.50	0.85669
23	50	63.41	0.09641
24	50	79.77	0.00471
25	50	55.50	0.27529
26	50	65.55	0.06903
27	50	36.26	0.92739
28	50	53.91	0.32709
29	50	29.31	0.99141
30	50	62.39	0.11223
31	50	48.83	0.52046

32	50	38.98	0.87030
33	50	33.31	0.96660
34	50	55.94	0.26183
35	50	44.43	0.69553
36	50	49.99	0.47367
37	50	36.06	0.93081
38	50	35.04	0.94634
39	50	50.23	0.46446
40	50	54.47	0.30827
41	50	33.92	0.96028
42	50	66.91	0.05522
43	50	48.86	0.51911
44	50	34.08	0.95847
45	50	54.65	0.30251
46	50	34.80	0.94952
47	50	50.23	0.46421
48	50	60.78	0.14118
49	50	58.20	0.19904
50	50	64.46	0.08207
51	50	39.81	0.84856
52	50	56.99	0.23114
53	50	41.25	0.80623
54	50	46.05	0.63270
55	50	47.31	0.58190
56	50	63.91	0.08934
57	50	41.84	0.78757
58	50	52.41	0.38056
59	50	46.91	0.59818
60	50	48.90	0.51744
61	50	48.23	0.54479
62	50	55.34	0.28017
63	50	59.97	0.15796
64	50	52.62	0.37304
65	50	48.94	0.51581
66	50	39.88	0.84656
67	50	45.15	0.66791
68	50	53.19	0.35225
69	50	42.27	0.77304
70	50	50.94	0.43655
71	50	42.78	0.75581
72	50	33.82	0.96138
73	50	53.83	0.32990
74	50	52.77	0.36733
75	50	46.89	0.59877
76	50	52.03	0.39466
77	50	54.58	0.30480
78	50	60.43	0.14835
79	50	42.39	0.76893
80	50	38.85	0.87343
81	50	79.65	0.00483
82	50	43.42	0.73304
83	50	45.68	0.64730
84	50	41.02	0.81336
85	50	45.67	0.64762
86	50	49.74	0.48384
87	50	72.47	0.02054
88	50	45.18	0.66665

89	50	32.19	0.97627
90	50	59.44	0.16958
91	50	44.21	0.70385
92	50	51.63	0.40980
93	50	51.26	0.42394
94	50	60.08	0.15548
95	50	44.77	0.68258
96	50	47.70	0.56613
97	50	57.61	0.21443
98	50	35.76	0.93556
99	50	55.87	0.26392
100	50	81.73	0.00307
Combined P-Value for 100 tests (Using KS method)			0.73980

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	7.80	0.80020
2	12	12.41	0.41353
3	12	8.30	0.76097
4	12	11.73	0.46782
5	12	24.31	0.01844
6	12	18.68	0.09657
7	12	13.48	0.33547
8	12	10.40	0.58073
9	12	9.44	0.66509
10	12	12.48	0.40758
11	12	7.90	0.79281
12	12	18.95	0.08984
13	12	12.07	0.44032
14	12	14.36	0.27816
15	12	11.06	0.52381
16	12	19.70	0.07296
17	12	18.47	0.10206
18	12	11.68	0.47175
19	12	13.79	0.31451
20	12	6.19	0.90620
21	12	15.56	0.21239
22	12	6.68	0.87802
23	12	15.39	0.22067
24	12	20.09	0.06535
25	12	10.92	0.53560
26	12	17.01	0.14924
27	12	19.39	0.07947

28	12	6.83	0.86880
29	12	17.94	0.11764
30	12	10.41	0.58036
31	12	14.79	0.25330
32	12	7.68	0.80970
33	12	23.40	0.02451
34	12	8.23	0.76701
35	12	14.56	0.26621
36	12	7.38	0.83131
37	12	9.47	0.66276
38	12	17.03	0.14851
39	12	15.20	0.23081
40	12	12.53	0.40404
41	12	23.36	0.02481
42	12	11.46	0.48969
43	12	12.60	0.39841
44	12	13.64	0.32456
45	12	9.02	0.70094
46	12	7.74	0.80483
47	12	8.96	0.70614
48	12	8.44	0.74988
49	12	13.51	0.33303
50	12	16.85	0.15523
51	12	6.65	0.88005
52	12	7.16	0.84718
53	12	11.09	0.52161
54	12	8.87	0.71422
55	12	8.18	0.77124
56	12	14.46	0.27203
57	12	8.65	0.73220
58	12	9.71	0.64118
59	12	9.56	0.65482
60	12	14.13	0.29264
61	12	9.87	0.62773
62	12	5.91	0.92064
63	12	8.41	0.75240
64	12	14.22	0.28668
65	12	7.04	0.85528
66	12	10.37	0.58321
67	12	8.12	0.77551
68	12	11.08	0.52203
69	12	14.33	0.28000
70	12	12.39	0.41505
71	12	5.85	0.92343
72	12	8.46	0.74854
73	12	13.74	0.31779
74	12	20.27	0.06212
75	12	13.45	0.33688
76	12	8.57	0.73923
77	12	13.77	0.31580
78	12	5.46	0.94094
79	12	9.90	0.62488
80	12	25.22	0.01380
81	12	15.08	0.23711
82	12	6.94	0.86144
83	12	9.42	0.66636
84	12	12.73	0.38909

85	12	3.47	0.99120
86	12	18.84	0.09240
87	12	14.54	0.26750
88	12	16.28	0.17893
89	12	12.03	0.44292
90	12	14.09	0.29525
91	12	8.90	0.71167
92	12	8.60	0.73632
93	12	8.60	0.73653
94	12	8.51	0.74373
95	12	11.20	0.51152
96	12	6.88	0.86576
97	12	23.04	0.02736
98	12	8.17	0.77182
99	12	6.63	0.88094
100	12	5.49	0.93958
Combined P-Value for 100 tests (Using KS method)			0.84049

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	10.77	0.54834
2	12	12.68	0.39303
3	12	11.73	0.46782
4	12	8.77	0.72251
5	12	11.00	0.52898
6	12	22.40	0.03327
7	12	14.12	0.29342
8	12	21.00	0.05043
9	12	6.67	0.87884
10	12	13.23	0.35253
11	12	5.44	0.94146
12	12	12.58	0.40002
13	12	10.77	0.54899
14	12	8.49	0.74612
15	12	10.86	0.54059
16	12	10.31	0.58843
17	12	9.88	0.62615
18	12	6.80	0.87071
19	12	13.03	0.36706
20	12	9.51	0.65918
21	12	10.08	0.60886
22	12	7.07	0.85262
23	12	3.67	0.98874
24	12	13.24	0.35205
25	12	10.40	0.58102
26	12	7.43	0.82772
27	12	5.71	0.92982
28	12	15.73	0.20402
29	12	19.78	0.07142
30	12	7.04	0.85498
31	12	18.88	0.09139

32	12	14.24	0.28564
33	12	9.90	0.62505
34	12	11.88	0.45551
35	12	12.73	0.38888
36	12	10.84	0.54297
37	12	14.66	0.26040
38	12	5.53	0.93790
39	12	13.09	0.36282
40	12	20.22	0.06313
41	12	16.76	0.15890
42	12	24.68	0.01641
43	12	13.11	0.36089
44	12	13.38	0.34207
45	12	8.11	0.77655
46	12	13.24	0.35182
47	12	13.50	0.33369
48	12	8.34	0.75784
49	12	7.59	0.81599
50	12	9.92	0.62306
51	12	11.28	0.50542
52	12	9.05	0.69864
53	12	13.99	0.30118
54	12	22.91	0.02846
55	12	10.52	0.57033
56	12	10.43	0.57868
57	12	25.14	0.01417
58	12	6.29	0.90086
59	12	9.96	0.61916
60	12	20.89	0.05202
61	12	20.55	0.05742
62	12	8.01	0.78440
63	12	15.50	0.21532
64	12	13.71	0.31978
65	12	14.28	0.28342
66	12	13.56	0.32969
67	12	13.00	0.36907
68	12	12.36	0.41718
69	12	10.16	0.60158
70	12	14.60	0.26400
71	12	12.09	0.43851
72	12	9.33	0.67478
73	12	11.05	0.52482
74	12	10.37	0.58344
75	12	13.47	0.33593
76	12	16.16	0.18408
77	12	5.42	0.94247
78	12	14.49	0.27029
79	12	13.77	0.31548
80	12	13.89	0.30788
81	12	6.12	0.91011
82	12	12.15	0.43347
83	12	13.45	0.33716
84	12	15.95	0.19332
85	12	11.65	0.47417
86	12	8.48	0.74634
87	12	8.90	0.71153
88	12	15.44	0.21844

89	12	16.88	0.15407
90	12	9.85	0.62944
91	12	6.13	0.90943
92	12	21.34	0.04556
93	12	7.46	0.82560
94	12	19.23	0.08305
95	12	30.33	0.00249
96	12	6.65	0.88010
97	12	8.68	0.73030
98	12	23.41	0.02443
99	12	7.25	0.84069
100	12	23.53	0.02353
Combined P-Value for 100 tests (Using KS method)			0.51804

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)	0.77190	1.00000
Opening Score (Dealer)	0.98172	1.00000
Dealer's Final Score	0.73980	1.00000
Player Cards Rank	0.84049	1.00000
Dealer Cards Rank	0.51804	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: 09 September 2025

Signed:



Alvin Rizaldi
Chief Executive Officer
iTech Labs

Date: 09 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.