

Blackjack Cards Analysis – December 2025

The Directors

Entain Plc

This confirms that iTech Labs has examined the game logs for blackjack games from **December 1, 2025**, to **December 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	20.37	0.25564
2	17	9.10	0.93723
3	17	8.10	0.96446
4	17	21.10	0.22191
5	17	14.91	0.60194
6	17	19.35	0.30875
7	17	17.08	0.44874
8	17	12.48	0.77013
9	17	22.46	0.16779
10	17	21.13	0.22043
11	17	15.32	0.57225
12	17	35.52	0.00531

Test No.	DOF	ChiSqr	P-Value
13	17	12.55	0.76606
14	17	28.98	0.03474
15	17	15.16	0.58372
16	17	21.04	0.22435
17	17	11.91	0.80558
18	17	29.16	0.03310
19	17	21.84	0.19094
20	17	19.12	0.32179
21	17	8.95	0.94189
22	17	3.66	0.99972
23	17	27.87	0.04648
24	17	6.95	0.98425
25	17	23.11	0.14569
26	17	20.63	0.24322
27	17	9.85	0.90974
28	17	25.15	0.09145
29	17	21.23	0.21630
30	17	11.99	0.80083
31	17	22.58	0.16348
32	17	27.89	0.04626
33	17	24.56	0.10494
34	17	11.63	0.82196
35	17	15.71	0.54413
36	17	12.24	0.78526
37	17	19.73	0.28803
38	17	12.25	0.78496
39	17	22.15	0.17907
40	17	17.42	0.42608
41	17	18.42	0.36266
42	17	21.45	0.20687
43	17	11.38	0.83598

Test No.	DOF	ChiSqr	P-Value
44	17	19.56	0.29712
45	17	18.63	0.35047
46	17	16.28	0.50434
47	17	13.87	0.67605
48	17	18.61	0.35161
49	17	17.15	0.44431
50	17	24.52	0.10595
51	17	16.46	0.49173
52	17	17.86	0.39750
53	17	19.15	0.32014
54	17	12.73	0.75415
55	17	17.24	0.43818
56	17	11.45	0.83222
57	17	18.26	0.37256
58	17	6.94	0.98432
59	17	24.03	0.11866
60	17	28.30	0.04160
61	17	10.81	0.86625
62	17	19.20	0.31707
63	17	25.58	0.08237
64	17	17.34	0.43186
65	17	12.86	0.74551
66	17	17.15	0.44453
67	17	33.82	0.00886
68	17	28.13	0.04344
69	17	13.29	0.71664
70	17	14.52	0.63011
71	17	23.29	0.14006
72	17	9.23	0.93283
73	17	14.96	0.59861
74	17	24.93	0.09622

Test No.	DOF	ChiSqr	P-Value
75	17	15.17	0.58327
76	17	36.31	0.00417
77	17	31.77	0.01608
78	17	11.55	0.82634
79	17	10.49	0.88194
80	17	18.92	0.33320
81	17	13.06	0.73189
82	17	22.90	0.15242
83	17	13.11	0.72864
84	17	16.20	0.50969
85	17	12.00	0.80008
86	17	17.32	0.43311
87	17	15.00	0.59577
88	17	10.86	0.86372
89	17	16.37	0.49798
90	17	27.14	0.05605
91	17	8.98	0.94086
92	17	22.17	0.17828
93	17	18.23	0.37427
94	17	21.17	0.21872
95	17	22.30	0.17337
96	17	17.66	0.41063
97	17	19.22	0.31605
98	17	13.89	0.67498
99	17	21.20	0.21746
100	17	8.39	0.95741
Combined P-Value for 100 tests (Using KS method)			0.15749

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.

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

Test No.	DOF	ChiSqr	P-Value
1	17	34.66	0.00689
2	17	11.18	0.84694
3	17	15.67	0.54717
4	17	17.85	0.39847
5	17	15.48	0.56083
6	17	14.91	0.60223
7	17	11.24	0.84404
8	17	20.42	0.25341
9	17	25.91	0.07612
10	17	15.28	0.57501
11	17	13.75	0.68478
12	17	13.91	0.67336
13	17	22.26	0.17507
14	17	16.51	0.48800
15	17	17.02	0.45287
16	17	12.03	0.79828
17	17	20.39	0.25482
18	17	18.49	0.35845
19	17	11.31	0.84022
20	17	17.50	0.42123
21	17	14.87	0.60479
22	17	22.67	0.16042
23	17	11.07	0.85278
24	17	22.58	0.16356
25	17	21.04	0.22432
26	17	13.02	0.73490
27	17	13.71	0.68742
28	17	13.10	0.72961
29	17	17.90	0.39487

Test No.	DOF	ChiSqr	P-Value
30	17	21.48	0.20566
31	17	7.56	0.97499
32	17	20.52	0.24842
33	17	19.13	0.32087
34	17	14.44	0.63587
35	17	13.55	0.69836
36	17	15.54	0.55695
37	17	14.73	0.61509
38	17	19.17	0.31906
39	17	14.06	0.66269
40	17	25.82	0.07789
41	17	17.18	0.44253
42	17	22.40	0.17000
43	17	11.59	0.82457
44	17	25.25	0.08931
45	17	25.51	0.08395
46	17	18.74	0.34379
47	17	16.57	0.48379
48	17	21.42	0.20816
49	17	22.68	0.15979
50	17	22.95	0.15080
51	17	6.18	0.99186
52	17	9.96	0.90525
53	17	13.07	0.73159
54	17	18.02	0.38777
55	17	15.66	0.54807
56	17	18.96	0.33112
57	17	18.90	0.33449
58	17	39.41	0.00157
59	17	20.25	0.26165
60	17	20.12	0.26835

Test No.	DOF	ChiSqr	P-Value
61	17	26.75	0.06176
62	17	13.36	0.71190
63	17	16.90	0.46101
64	17	18.84	0.33787
65	17	9.74	0.91434
66	17	17.55	0.41797
67	17	13.13	0.72734
68	17	16.11	0.51636
69	17	15.19	0.58187
70	17	10.27	0.89185
71	17	13.15	0.72636
72	17	11.76	0.81429
73	17	14.93	0.60063
74	17	22.07	0.18200
75	17	11.60	0.82374
76	17	24.55	0.10517
77	17	11.48	0.83077
78	17	17.05	0.45079
79	17	8.13	0.96369
80	17	22.28	0.17426
81	17	12.67	0.75768
82	17	16.47	0.49089
83	17	18.74	0.34391
84	17	9.08	0.93778
85	17	22.54	0.16474
86	17	14.95	0.59874
87	17	10.47	0.88266
88	17	13.14	0.72649
89	17	9.58	0.92043
90	17	9.62	0.91860
91	17	10.47	0.88296

Test No.	DOF	ChiSqr	P-Value
92	17	9.06	0.93841
93	17	18.70	0.34626
94	17	13.01	0.73567
95	17	25.46	0.08478
96	17	10.77	0.86830
97	17	15.27	0.57639
98	17	20.04	0.27212
99	17	30.65	0.02205
100	17	16.02	0.52217
Combined P-Value for 100 tests (Using KS method)			0.95382

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.

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	51.28	0.42330
2	50	60.97	0.13757
3	50	40.19	0.83789
4	50	51.08	0.43117
5	50	74.06	0.01514
6	50	47.22	0.58564
7	50	52.88	0.36358
8	50	55.19	0.28486
9	50	46.98	0.59545
10	50	58.88	0.18240
11	50	36.72	0.91928
12	50	39.96	0.84446
13	50	51.04	0.43263

Test No.	DOF	ChiSqr	P-Value
14	50	62.33	0.11320
15	50	51.89	0.40002
16	50	44.21	0.70380
17	50	43.70	0.72288
18	50	58.72	0.18624
19	50	42.99	0.74843
20	50	44.28	0.70126
21	50	55.66	0.27019
22	50	39.97	0.84415
23	50	62.05	0.11801
24	50	51.16	0.42773
25	50	65.03	0.07502
26	50	59.50	0.16809
27	50	47.11	0.59014
28	50	48.78	0.52239
29	50	43.04	0.74638
30	50	38.42	0.88361
31	50	49.98	0.47439
32	50	57.10	0.22818
33	50	41.82	0.78808
34	50	47.83	0.56110
35	50	68.75	0.04037
36	50	42.87	0.75242
37	50	54.80	0.29741
38	50	44.61	0.68857
39	50	45.22	0.66537
40	50	46.41	0.61806
41	50	48.77	0.52266
42	50	39.33	0.86119
43	50	49.60	0.48952
44	50	36.50	0.92327

Test No.	DOF	ChiSqr	P-Value
45	50	48.35	0.53996
46	50	52.63	0.37274
47	50	57.41	0.21960
48	50	46.59	0.61103
49	50	32.95	0.96996
50	50	60.34	0.15004
51	50	69.35	0.03635
52	50	55.24	0.28341
53	50	40.50	0.82899
54	50	60.46	0.14764
55	50	40.85	0.81857
56	50	46.80	0.60238
57	50	57.48	0.21788
58	50	61.02	0.13664
59	50	61.85	0.12145
60	50	55.74	0.26776
61	50	34.95	0.94757
62	50	74.42	0.01411
63	50	47.11	0.59008
64	50	42.06	0.78028
65	50	56.48	0.24559
66	50	57.84	0.20820
67	50	42.10	0.77878
68	50	57.73	0.21131
69	50	56.37	0.24899
70	50	46.93	0.59714
71	50	46.32	0.62170
72	50	63.05	0.10174
73	50	57.96	0.20530
74	50	53.04	0.35774
75	50	48.48	0.53442

Test No.	DOF	ChiSqr	P-Value
76	50	36.77	0.91832
77	50	48.93	0.51640
78	50	52.56	0.37531
79	50	47.88	0.55897
80	50	39.36	0.86037
81	50	41.65	0.79348
82	50	46.26	0.62406
83	50	52.43	0.38005
84	50	59.48	0.16865
85	50	48.19	0.54621
86	50	44.51	0.69271
87	50	53.32	0.34789
88	50	45.38	0.65905
89	50	57.20	0.22532
90	50	41.96	0.78340
91	50	48.57	0.53096
92	50	51.73	0.40611
93	50	68.13	0.04494
94	50	40.28	0.83522
95	50	41.57	0.79606
96	50	39.50	0.85669
97	50	42.16	0.77700
98	50	47.16	0.58823
99	50	42.38	0.76939
100	50	39.58	0.85481
Combined P-Value for 100 tests (Using KS method)			0.71604

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. 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	11.60	0.47867
2	12	8.70	0.72832
3	12	6.61	0.88217
4	12	3.24	0.99363
5	12	11.26	0.50711
6	12	11.19	0.51310
7	12	14.94	0.24465
8	12	17.27	0.13963
9	12	10.03	0.61376
10	12	21.76	0.04032
11	12	9.75	0.63763
12	12	5.09	0.95493
13	12	4.67	0.96811
14	12	13.66	0.32276
15	12	15.99	0.19186
16	12	13.46	0.33648
17	12	6.65	0.87975
18	12	18.87	0.09184
19	12	17.81	0.12159
20	12	8.70	0.72792
21	12	10.37	0.58357
22	12	6.53	0.88716
23	12	4.01	0.98331
24	12	3.91	0.98499
25	12	6.90	0.86413

Test No.	DOF	ChiSqr	P-Value
26	12	16.63	0.16396
27	12	24.90	0.01528
28	12	13.62	0.32538
29	12	11.05	0.52473
30	12	11.67	0.47243
31	12	17.86	0.12013
32	12	13.66	0.32282
33	12	18.88	0.09157
34	12	12.27	0.42411
35	12	10.24	0.59530
36	12	8.53	0.74259
37	12	17.28	0.13948
38	12	13.86	0.30947
39	12	13.78	0.31516
40	12	13.40	0.34041
41	12	12.05	0.44207
42	12	13.24	0.35200
43	12	17.11	0.14541
44	12	16.43	0.17246
45	12	10.17	0.60129
46	12	4.39	0.97541
47	12	12.18	0.43096
48	12	5.39	0.94355
49	12	10.73	0.55230
50	12	17.62	0.12779
51	12	14.70	0.25833
52	12	10.68	0.55666
53	12	14.94	0.24456
54	12	15.33	0.22393
55	12	6.85	0.86758
56	12	9.87	0.62744

Test No.	DOF	ChiSqr	P-Value
57	12	17.29	0.13902
58	12	8.67	0.73118
59	12	4.01	0.98318
60	12	12.39	0.41493
61	12	7.82	0.79916
62	12	17.45	0.13334
63	12	15.42	0.21922
64	12	22.79	0.02957
65	12	19.07	0.08676
66	12	10.51	0.57158
67	12	19.22	0.08326
68	12	9.51	0.65851
69	12	8.40	0.75346
70	12	10.27	0.59252
71	12	6.06	0.91323
72	12	14.21	0.28765
73	12	23.19	0.02616
74	12	12.19	0.43063
75	12	13.57	0.32889
76	12	8.04	0.78193
77	12	9.16	0.68918
78	12	17.03	0.14848
79	12	4.23	0.97897
80	12	25.38	0.01310
81	12	19.81	0.07076
82	12	9.52	0.65782
83	12	13.84	0.31076
84	12	14.92	0.24612
85	12	5.31	0.94678
86	12	17.07	0.14699
87	12	6.49	0.88920

Test No.	DOF	ChiSqr	P-Value
88	12	10.62	0.56205
89	12	16.48	0.17027
90	12	5.77	0.92733
91	12	12.94	0.37308
92	12	7.48	0.82418
93	12	8.03	0.78255
94	12	8.16	0.77246
95	12	13.87	0.30917
96	12	13.51	0.33323
97	12	12.59	0.39941
98	12	9.01	0.70195
99	12	8.78	0.72135
100	12	5.86	0.92290
Combined P-Value for 100 tests (Using KS method)			0.70282

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.

2.2 Blackjack rank statistics for all dealer cards:

Test No.	DOF	ChiSqr	P-Value
1	12	21.41	0.04472
2	12	12.51	0.40552
3	12	12.81	0.38325
4	12	6.32	0.89891
5	12	17.60	0.12839
6	12	11.28	0.50485
7	12	9.49	0.66027
8	12	1.73	0.99972
9	12	10.84	0.54283

Test No.	DOF	ChiSqr	P-Value
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10	12	9.04	0.69915
11	12	12.52	0.40516
12	12	6.51	0.88797
13	12	11.09	0.52140
14	12	9.14	0.69076
15	12	17.45	0.13339
16	12	10.42	0.57938
17	12	12.25	0.42584
18	12	10.41	0.58016
19	12	18.70	0.09611
20	12	15.85	0.19809
21	12	6.49	0.88931
22	12	25.54	0.01245
23	12	20.69	0.05504
24	12	11.96	0.44899
25	12	11.80	0.46184
26	12	9.75	0.63827
27	12	9.05	0.69871
28	12	10.05	0.61140
29	12	9.45	0.66445
30	12	15.42	0.21910
31	12	13.81	0.31292
32	12	12.80	0.38406
33	12	11.76	0.46516
34	12	12.69	0.39196
35	12	17.47	0.13264
36	12	7.94	0.78997
37	12	10.95	0.53302
38	12	9.65	0.64623
39	12	11.14	0.51718
40	12	12.26	0.42475

Test No.	DOF	ChiSqr	P-Value
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41	12	8.90	0.71112
42	12	13.18	0.35597
43	12	9.69	0.64353
44	12	4.33	0.97669
45	12	8.92	0.70988
46	12	11.30	0.50340
47	12	16.91	0.15307
48	12	8.78	0.72136
49	12	5.74	0.92839
50	12	15.64	0.20843
51	12	7.89	0.79380
52	12	27.39	0.00679
53	12	3.70	0.98829
54	12	19.78	0.07133
55	12	4.51	0.97245
56	12	10.16	0.60150
57	12	26.39	0.00945
58	12	13.93	0.30499
59	12	8.22	0.76773
60	12	6.75	0.87343
61	12	11.91	0.45332
62	12	11.01	0.52814
63	12	12.32	0.42043
64	12	26.75	0.00838
65	12	17.96	0.11684
66	12	5.35	0.94522
67	12	11.35	0.49936
68	12	17.62	0.12782
69	12	19.40	0.07942
70	12	11.50	0.48630
71	12	8.94	0.70766

Test No.	DOF	ChiSqr	P-Value
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72	12	17.96	0.11686
73	12	18.81	0.09324
74	12	10.93	0.53491
75	12	5.98	0.91686
76	12	7.91	0.79192
77	12	18.23	0.10887
78	12	8.22	0.76760
79	12	4.65	0.96856
80	12	19.60	0.07500
81	12	13.97	0.30238
82	12	23.20	0.02608
83	12	10.44	0.57718
84	12	14.76	0.25490
85	12	11.21	0.51062
86	12	3.89	0.98529
87	12	5.66	0.93226
88	12	11.68	0.47176
89	12	23.45	0.02415
90	12	15.30	0.22519
91	12	13.44	0.33777
92	12	12.94	0.37309
93	12	19.34	0.08056
94	12	12.04	0.44240
95	12	14.83	0.25085
96	12	10.63	0.56111
97	12	12.16	0.43321
98	12	14.61	0.26365
99	12	4.35	0.97617
100	12	8.05	0.78098
Combined P-Value for 100 tests (Using KS method)			0.75267

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. 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)	0.15749	0.78743
Opening Score (Dealer)	0.95382	1.00000
Dealer's Final Score	0.71604	1.00000
Player Cards Rank	0.70282	1.00000
Dealer Cards Rank	0.75267	1.00000
Combined P-Value using Holm's Method		0.78743

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.

4. Conclusion

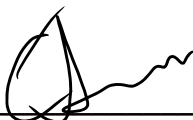
Analysis of actual data from game logs for 'player opening score', 'dealer opening score', 'dealer final score', 'player card rank' and 'dealer card rank' indicated statistical randomness. The results were satisfactory for 8 decks blackjack.

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.

Signed:



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