Blackjack Cards Analysis – September 2026

The Directors
Entain Plc

This confirms that iTech Labs has examined the game logs for blackjack games from **September 1, 2026 to September 31, 2026**, 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	16.06	0.51987
2	17	17.76	0.40442
3	17	23.64	0.12961
4	17	18.77	0.34188
5	17	23.58	0.13116
6	17	12.60	0.76254
7	17	9.45	0.92515
8	17	10.15	0.89708
9	17	15.30	0.57383
10	17	18.77	0.34216
11	17	17.88	0.39621
12	17	8.18	0.96251
13	17	23.90	0.12213

Test No.	DOF	ChiSqr	P-Value
14	17	8.28	0.96011
15	17	9.13	0.93624
16	17	22.94	0.15109
17	17	11.26	0.84291
18	17	10.94	0.85975
19	17	13.12	0.72781
20	17	14.19	0.65348
21	17	19.24	0.31467
22	17	10.66	0.87386
23	17	20.93	0.22940
24	17	13.71	0.68775
25	17	20.20	0.26423
26	17	15.81	0.53736
27	17	9.89	0.90801
28	17	8.86	0.94451
29	17	18.35	0.36693
30	17	22.09	0.18120
31	17	14.15	0.65625
32	17	10.41	0.88535
33	17	13.17	0.72476
34	17	15.20	0.58110
35	17	14.69	0.61765
36	17	22.74	0.15775
37	17	10.54	0.87925
38	17	15.57	0.55485
39	17	14.16	0.65601
40	17	17.66	0.41056
41	17	11.22	0.84489
42	17	8.92	0.94281
43	17	15.52	0.55792
44	17	24.62	0.10356

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Test No.	DOF	ChiSqr	P-Value
45	17	6.95	0.98416
46	17	13.60	0.69538
47	17	11.04	0.85443
48	17	16.32	0.50121
49	17	26.33	0.06867
50	17	14.85	0.60664
51	17	15.06	0.59128
52	17	28.82	0.03626
53	17	11.35	0.83796
54	17	24.76	0.10011
55	17	8.85	0.94493
56	17	18.72	0.34469
57	17	13.85	0.67767
58	17	16.49	0.48906
59	17	17.33	0.43252
60	17	15.83	0.53566
61	17	19.63	0.29335
62	17	13.59	0.69564
63	17	13.63	0.69319
64	17	12.35	0.77848
65	17	14.33	0.64377
66	17	11.05	0.85375
67	17	17.29	0.43480
68	17	11.09	0.85202
69	17	25.77	0.07882
70	17	11.42	0.83368
71	17	22.19	0.17746
72	17	12.62	0.76142
73	17	12.97	0.73797
74	17	12.53	0.76690
75	17	6.80	0.98599

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Test No.	DOF	ChiSqr	P-Value
76	17	17.27	0.43653
77	17	28.67	0.03766
78	17	20.99	0.22661
79	17	21.19	0.21804
80	17	28.15	0.04326
81	17	21.14	0.22011
82	17	27.25	0.05455
83	17	40.74	0.00102
84	17	11.21	0.84545
85	17	12.53	0.76690
86	17	16.87	0.46305
87	17	14.90	0.60273
88	17	18.56	0.35437
89	17	11.36	0.83746
90	17	25.56	0.08281
91	17	12.36	0.77777
92	17	19.14	0.32076
93	17	10.38	0.88705
94	17	17.78	0.40286
95	17	12.02	0.79873
96	17	13.63	0.69305
97	17	24.34	0.11050
98	17	15.54	0.55651
99	17	44.75	0.00027
100	17	38.46	0.00213
Combined P-Value for 100 tests (Using KS method)			0.30462

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	21.76	0.19412
2	17	23.95	0.12072
3	17	27.96	0.04546
4	17	12.65	0.75920
5	17	10.46	0.88299
6	17	5.88	0.99397
7	17	13.76	0.68411
8	17	17.94	0.39285
9	17	10.65	0.87402
10	17	22.89	0.15281
11	17	24.58	0.10452
12	17	14.98	0.59720
13	17	33.62	0.00939
14	17	17.35	0.43059
15	17	14.36	0.64183
16	17	29.18	0.03294
17	17	10.59	0.87710
18	17	17.26	0.43674
19	17	11.26	0.84284
20	17	16.12	0.51553
21	17	16.16	0.51279
22	17	13.74	0.68507
23	17	17.34	0.43134
24	17	17.68	0.40920
25	17	14.88	0.60423
26	17	10.33	0.88939
27	17	18.23	0.37443
28	17	13.01	0.73548
29	17	22.15	0.17903
30	17	10.68	0.87280

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Test No.	DOF	ChiSqr	P-Value
31	17	14.82	0.60843
32	17	11.94	0.80398
33	17	6.07	0.99272
34	17	15.48	0.56116
35	17	18.17	0.37820
36	17	21.85	0.19047
37	17	22.66	0.16053
38	17	25.22	0.08993
39	17	11.14	0.84920
40	17	13.75	0.68485
41	17	17.42	0.42626
42	17	18.37	0.36600
43	17	18.90	0.33433
44	17	13.35	0.71245
45	17	13.22	0.72152
46	17	11.90	0.80611
47	17	18.09	0.38313
48	17	27.19	0.05532
49	17	28.50	0.03947
50	17	13.25	0.71921
51	17	11.56	0.82601
52	17	23.36	0.13784
53	17	9.28	0.93106
54	17	26.87	0.05997
55	17	23.10	0.14607
56	17	20.99	0.22674
57	17	21.27	0.21448
58	17	12.05	0.79735
59	17	29.99	0.02644
60	17	12.69	0.75657
61	17	19.00	0.32869

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Test No.	DOF	ChiSqr	P-Value
62	17	27.98	0.04519
63	17	9.56	0.92121
64	17	9.61	0.91929
65	17	18.35	0.36687
66	17	17.19	0.44131
67	17	13.75	0.68441
68	17	14.73	0.61511
69	17	10.58	0.87750
70	17	7.97	0.96724
71	17	17.92	0.39420
72	17	12.70	0.75603
73	17	15.74	0.54244
74	17	19.84	0.28267
75	17	15.23	0.57873
76	17	19.33	0.31002
77	17	13.46	0.70475
78	17	12.44	0.77297
79	17	6.12	0.99238
80	17	16.77	0.46983
81	17	13.30	0.71567
82	17	14.35	0.64241
83	17	17.11	0.44679
84	17	10.97	0.85835
85	17	15.16	0.58401
86	17	8.44	0.95614
87	17	33.22	0.01058
88	17	20.63	0.24317
89	17	33.49	0.00977
90	17	12.81	0.74887
91	17	13.12	0.72834
92	17	18.92	0.33302

Test No.	DOF	ChiSqr	P-Value
93	17	20.49	0.25001
94	17	18.75	0.34298
95	17	17.71	0.40709
96	17	19.84	0.28235
97	17	10.47	0.88278
98	17	14.68	0.61837
99	17	22.96	0.15055
100	17	18.48	0.35892
Combined P-Value for 100 tests (Using KS method)			0.79275

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	54.95	0.29271
2	50	75.32	0.01181
3	50	34.77	0.94990
4	50	37.30	0.90811
5	50	55.35	0.27997
6	50	35.37	0.94156
7	50	32.62	0.97288
8	50	54.94	0.29292
9	50	51.02	0.43318
10	50	54.67	0.30186
11	50	34.93	0.94772
12	50	52.99	0.35962
13	50	46.70	0.60674
14	50	64.09	0.08694
15	50	52.64	0.37232
16	50	51.84	0.40210

Test No.	DOF	ChiSqr	P-Value
17	50	44.27	0.70165
18	50	32.71	0.97209
19	50	40.40	0.83192
20	50	40.83	0.81929
21	50	52.28	0.38565
22	50	66.35	0.06062
23	50	50.34	0.45995
24	50	41.38	0.80215
25	50	48.90	0.51748
26	50	48.78	0.52254
27	50	58.52	0.19117
28	50	71.33	0.02541
29	50	27.73	0.99553
30	50	45.16	0.66761
31	50	61.68	0.12440
32	50	53.59	0.33834
33	50	51.36	0.42021
34	50	58.50	0.19164
35	50	51.74	0.40554
36	50	55.81	0.26575
37	50	56.71	0.23901
38	50	48.32	0.54110
39	50	45.02	0.67301
40	50	53.62	0.33721
41	50	56.74	0.23813
42	50	62.73	0.10667
43	50	38.30	0.88653
44	50	55.57	0.27299
45	50	55.61	0.27186
46	50	63.41	0.09635
47	50	54.61	0.30361

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Test No.	DOF	ChiSqr	P-Value
48	50	45.15	0.66797
49	50	49.64	0.48756
50	50	42.18	0.77628
51	50	43.65	0.72449
52	50	57.08	0.22879
53	50	47.56	0.57195
54	50	44.27	0.70181
55	50	36.90	0.91583
56	50	53.41	0.34447
57	50	47.15	0.58851
58	50	47.56	0.57185
59	50	45.04	0.67234
60	50	51.32	0.42180
61	50	45.29	0.66241
62	50	45.66	0.64809
63	50	64.24	0.08483
64	50	42.17	0.77652
65	50	52.05	0.39388
66	50	53.93	0.32646
67	50	60.04	0.15639
68	50	48.37	0.53884
69	50	55.43	0.27731
70	50	72.72	0.01962
71	50	43.29	0.73751
72	50	61.86	0.12116
73	50	42.81	0.75449
74	50	49.13	0.50820
75	50	53.73	0.33340
76	50	38.51	0.88164
77	50	67.23	0.05233
78	50	53.51	0.34120

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Test No.	DOF	ChiSqr	P-Value
79	50	40.45	0.83039
80	50	55.92	0.26241
81	50	40.78	0.82062
82	50	58.48	0.19221
83	50	49.34	0.49967
84	50	47.67	0.56740
85	50	42.07	0.77986
86	50	50.28	0.46217
87	50	57.82	0.20887
88	50	60.95	0.13794
89	50	48.75	0.52373
90	50	34.42	0.95437
91	50	57.31	0.22232
92	50	47.67	0.56739
93	50	48.15	0.54794
94	50	32.21	0.97617
95	50	62.97	0.10294
96	50	51.87	0.40090
97	50	43.47	0.73099
98	50	50.97	0.43532
99	50	31.90	0.97839
100	50	47.96	0.55579
Combined P-Value for 100 tests (Using KS method)			0.72874

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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	12.78	0.38540
2	12	19.35	0.08044
3	12	17.73	0.12404
4	12	20.59	0.05669
5	12	15.56	0.21219
6	12	13.27	0.34945
7	12	12.97	0.37087
8	12	8.16	0.77289
9	12	7.42	0.82892
10	12	8.99	0.70366
11	12	9.50	0.65939
12	12	11.36	0.49819
13	12	8.95	0.70707
14	12	9.43	0.66600
15	12	19.75	0.07188
16	12	25.58	0.01229
17	12	7.79	0.80131
18	12	18.45	0.10263
19	12	18.73	0.09527
20	12	9.26	0.68047
21	12	15.88	0.19688
22	12	9.49	0.66100
23	12	18.88	0.09154
24	12	10.03	0.61329
25	12	11.91	0.45302
26	12	9.78	0.63552
27	12	8.75	0.72440
28	12	7.72	0.80688
29	12	9.94	0.62090
30	12	12.16	0.43315

Test No.	DOF	ChiSqr	P-Value
31	12	12.99	0.36968
32	12	5.31	0.94668
33	12	10.06	0.61035
34	12	13.74	0.31756
35	12	17.29	0.13913
36	12	6.51	0.88800
37	12	5.91	0.92031
38	12	7.05	0.85425
39	12	10.01	0.61531
40	12	6.96	0.86017
41	12	4.42	0.97460
42	12	10.89	0.53798
43	12	12.10	0.43761
44	12	5.10	0.95461
45	12	17.50	0.13172
46	12	10.67	0.55750
47	12	13.61	0.32624
48	12	14.13	0.29242
49	12	17.26	0.14021
50	12	5.62	0.93399
51	12	7.85	0.79711
52	12	6.45	0.89163
53	12	7.12	0.84970
54	12	22.32	0.03411
55	12	10.81	0.54552
56	12	9.42	0.66681
57	12	10.74	0.55172
58	12	17.97	0.11649
59	12	7.85	0.79647
60	12	11.55	0.48249
61	12	15.36	0.22259

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Test No.	DOF	ChiSqr	P-Value
62	12	7.66	0.81125
63	12	11.55	0.48266
64	12	11.19	0.51308
65	12	9.88	0.62645
66	12	14.37	0.27745
67	12	17.41	0.13488
68	12	12.71	0.39060
69	12	12.98	0.37052
70	12	8.34	0.75792
71	12	10.66	0.55849
72	12	22.21	0.03519
73	12	6.40	0.89438
74	12	8.46	0.74790
75	12	18.61	0.09830
76	12	19.30	0.08150
77	12	12.71	0.39013
78	12	9.20	0.68582
79	12	22.59	0.03142
80	12	9.88	0.62635
81	12	10.22	0.59644
82	12	12.20	0.42978
83	12	19.33	0.08085
84	12	3.64	0.98913
85	12	9.85	0.62936
86	12	6.12	0.90992
87	12	9.00	0.70252
88	12	8.58	0.73854
89	12	26.94	0.00788
90	12	10.61	0.56256
91	12	6.88	0.86517
92	12	5.77	0.92736

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Test No.	DOF	ChiSqr	P-Value
93	12	8.25	0.76532
94	12	11.62	0.47645
95	12	6.96	0.86024
96	12	13.24	0.35186
97	12	7.79	0.80163
98	12	14.11	0.29347
99	12	37.52	0.00018
100	12	37.76	0.00017
Combined P-Value for 100 tests (Using KS method)			0.69005

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	15.09	0.23669
2	12	10.75	0.55076
3	12	11.79	0.46253
4	12	14.42	0.27456
5	12	4.42	0.97451
6	12	8.38	0.75447
7	12	22.85	0.02907
8	12	9.58	0.65306
9	12	5.69	0.93102
10	12	11.04	0.52576
11	12	13.36	0.34361
12	12	9.40	0.66835
13	12	11.34	0.49974
14	12	14.95	0.24413
15	12	13.17	0.35658
16	12	11.97	0.44819

Test No.	DOF	ChiSqr	P-Value
17	12	28.37	0.00489
18	12	17.67	0.12601
19	12	5.02	0.95715
20	12	10.86	0.54067
21	12	11.15	0.51573
22	12	6.96	0.86037
23	12	5.77	0.92721
24	12	12.32	0.41998
25	12	11.98	0.44769
26	12	15.06	0.23836
27	12	6.50	0.88872
28	12	11.95	0.44936
29	12	9.74	0.63875
30	12	8.12	0.77537
31	12	13.35	0.34398
32	12	11.97	0.44785
33	12	9.90	0.62435
34	12	15.12	0.23477
35	12	9.50	0.65939
36	12	3.61	0.98943
37	12	16.56	0.16690
38	12	13.16	0.35725
39	12	18.32	0.10631
40	12	13.44	0.33800
41	12	13.31	0.34682
42	12	4.67	0.96816
43	12	7.57	0.81803
44	12	8.06	0.78014
45	12	15.61	0.20987
46	12	5.15	0.95261
47	12	14.27	0.28391

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Test No.	DOF	ChiSqr	P-Value
48	12	8.37	0.75598
49	12	4.00	0.98339
50	12	6.08	0.91198
51	12	15.84	0.19879
52	12	15.34	0.22313
53	12	4.31	0.97714
54	12	16.29	0.17813
55	12	12.78	0.38492
56	12	9.02	0.70154
57	12	18.33	0.10602
58	12	13.18	0.35592
59	12	4.54	0.97150
60	12	7.67	0.81001
61	12	3.38	0.99222
62	12	19.07	0.08681
63	12	15.89	0.19610
64	12	5.57	0.93638
65	12	18.20	0.10980
66	12	26.15	0.01023
67	12	7.34	0.83459
68	12	15.54	0.21311
69	12	8.39	0.75420
70	12	5.82	0.92506
71	12	15.84	0.19844
72	12	8.31	0.76079
73	12	12.43	0.41183
74	12	21.08	0.04926
75	12	10.30	0.58970
76	12	21.02	0.05006
77	12	19.75	0.07203
78	12	12.33	0.41966

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Test No.	DOF	ChiSqr	P-Value
79	12	10.54	0.56835
80	12	10.87	0.54049
81	12	11.19	0.51264
82	12	6.19	0.90617
83	12	8.53	0.74216
84	12	15.59	0.21079
85	12	7.66	0.81125
86	12	16.52	0.16840
87	12	13.75	0.31666
88	12	5.94	0.91929
89	12	14.61	0.26356
90	12	4.36	0.97598
91	12	9.56	0.65440
92	12	11.08	0.52229
93	12	8.82	0.71816
94	12	8.50	0.74456
95	12	18.93	0.09029
96	12	9.99	0.61687
97	12	8.58	0.73837
98	12	7.78	0.80202
99	12	7.59	0.81657
100	12	17.08	0.14678
Combined P-Value for 100 tests (Using KS method)			0.55399

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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)	0.30462	1.00000
Opening Score (Dealer)	0.79275	1.00000
Dealer's Final Score	0.72874	1.00000
Player Cards Rank	0.69005	1.00000
Dealer Cards Rank	0.55399	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.

4. Conclusion

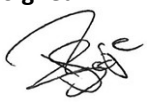
Analysis of actual data from game logs for 'player opening score', 'dealer opening score', 'dealer final score', 'player card rank' and 'dealer card rank' indicated statistical randomness. The results were satisfactory for 8 decks blackjack.

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:



James Boje
Managing Director EMEA
Executive
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