



GLI[®]

World Headquarters

600 Airport Road
Lakewood, NJ 08701

Phone (732) 942-3999
Fax (732) 942-0043
www.gaminglabs.com

30 December 2025

Suresh Yellayi
Entain Operations Limited
Suite 6, Atlantic Suites
Europort Avenue, Gibraltar

Re: Mathematical Analysis of *Blackjack*

File Number: MA-00-GSV-25-08

Dear Mr. Yellayi,

As per Entain Operations Limited's request, please find **Gaming Laboratories International, LLC's (GLI)** mathematical analysis of the following Blackjack:

This is to confirm that GLI has examined the Blackjack game logs in the gaming system of Entain Plc for the month of **November 2025** as recorded by the respective game servers and analyzed the Blackjack cards for statistical randomness.

1. *Blackjack*

This report only verifies the mathematical aspects of these games and DOES NOT offer an opinion as to whether or not these games are currently authorized for use in any jurisdiction.

Mathematical Analysis

Gaming Laboratories International, LLC (GLI) was requested by Entain Operations Limited to independently calculate the expected payback for the mentioned games and confirm that the returns are within the requirements. On the following page, please find a table containing the summary of our results.

GLI Austria GmbH
GLI Europe BV
GLI UK
GLI Italy
GLI South America

North American Offices

Colorado
Nevada
British Columbia

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	28.80	0.03638
2	17	21.88	0.18923
3	17	24.35	0.11026
4	17	18.98	0.32944
5	17	8.44	0.95623
6	17	7.19	0.98093
7	17	16.84	0.46539
8	17	22.71	0.15903
9	17	18.40	0.36387
10	17	17.57	0.41672
11	17	23.03	0.14830
12	17	16.23	0.50728

Test No.	DOF	ChiSqr	P-Value
13	17	16.24	0.50668
14	17	19.12	0.32194
15	17	21.71	0.19596
16	17	11.40	0.83512
17	17	13.31	0.71506
18	17	6.83	0.98563
19	17	18.81	0.33966
20	17	14.67	0.61923
21	17	16.26	0.50529
22	17	18.26	0.37284
23	17	16.83	0.46601
24	17	12.13	0.79220
25	17	13.65	0.69202
26	17	15.63	0.55048
27	17	25.47	0.08459
28	17	14.77	0.61172
29	17	11.87	0.80821
30	17	17.61	0.41406
31	17	16.51	0.48794
32	17	13.99	0.66811
33	17	16.54	0.48621
34	17	10.28	0.89153
35	17	18.05	0.38563

Test No.	DOF	ChiSqr	P-Value
36	17	16.05	0.52045
37	17	20.57	0.24611
38	17	14.88	0.60400
39	17	12.05	0.79729
40	17	14.05	0.66346
41	17	28.94	0.03507
42	17	14.05	0.66349
43	17	16.96	0.45678
44	17	15.66	0.54805
45	17	19.85	0.28201
46	17	22.11	0.18037
47	17	14.76	0.61274
48	17	8.50	0.95459
49	17	15.83	0.53614
50	17	17.30	0.43450
51	17	5.64	0.99528
52	17	11.79	0.81257
53	17	20.66	0.24205
54	17	24.00	0.11944
55	17	21.06	0.22374
56	17	14.79	0.61026
57	17	27.44	0.05187
58	17	19.36	0.30802

Test No.	DOF	ChiSqr	P-Value
59	17	16.48	0.48975
60	17	27.18	0.05552
61	17	15.15	0.58480
62	17	16.38	0.49708
63	17	19.92	0.27837
64	17	11.58	0.82481
65	17	14.67	0.61898
66	17	15.04	0.59247
67	17	23.20	0.14271
68	17	18.34	0.36785
69	17	21.02	0.22523
70	17	22.24	0.17579
71	17	32.02	0.01497
72	17	19.60	0.29493
73	17	17.24	0.43851
74	17	21.50	0.20492
75	17	20.36	0.25632
76	17	11.82	0.81064
77	17	11.99	0.80079
78	17	7.61	0.97420
79	17	11.88	0.80757
80	17	13.90	0.67452
81	17	17.33	0.43212

Test No.	DOF	ChiSqr	P-Value
82	17	9.38	0.92757
83	17	29.09	0.03366
84	17	24.00	0.11944
85	17	15.49	0.55999
86	17	23.24	0.14152
87	17	20.79	0.23571
88	17	14.88	0.60386
89	17	18.14	0.38003
90	17	23.61	0.13038
91	17	13.72	0.68691
92	17	13.90	0.67423
93	17	33.47	0.00983
94	17	16.93	0.45910
95	17	19.11	0.32226
96	17	16.83	0.46582
97	17	29.06	0.03401
98	17	33.74	0.00906
99	17	14.67	0.61956
100	17	33.44	0.00990
Combined P-Value for 100 tests (Using KS method)			0.10183

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	21.48	0.20535
2	17	23.23	0.14179
3	17	12.96	0.73854
4	17	20.06	0.27108
5	17	21.71	0.19599
6	17	18.26	0.37239
7	17	28.59	0.03848
8	17	22.07	0.18188
9	17	7.31	0.97924
10	17	18.83	0.33842
11	17	13.76	0.68397
12	17	18.81	0.33933
13	17	24.55	0.10534
14	17	21.18	0.21822
15	17	17.41	0.42705
16	17	7.47	0.97655
17	17	16.48	0.49032
18	17	17.23	0.43891
19	17	22.02	0.18388
20	17	9.92	0.90688
21	17	12.98	0.73733
22	17	25.52	0.08360
23	17	11.81	0.81172

Test No.	DOF	ChiSqr	P-Value
24	17	14.61	0.62361
25	17	16.71	0.47397
26	17	20.74	0.23831
27	17	18.40	0.36375
28	17	16.34	0.50015
29	17	25.44	0.08522
30	17	10.98	0.85757
31	17	17.83	0.39958
32	17	19.90	0.27952
33	17	28.75	0.03688
34	17	21.18	0.21831
35	17	21.80	0.19248
36	17	19.41	0.30547
37	17	21.21	0.21690
38	17	15.11	0.58748
39	17	15.50	0.55937
40	17	13.17	0.72479
41	17	11.95	0.80293
42	17	7.21	0.98069
43	17	17.33	0.43226
44	17	18.57	0.35354
45	17	15.11	0.58786
46	17	9.93	0.90658

Test No.	DOF	ChiSqr	P-Value
47	17	11.63	0.82208
48	17	16.73	0.47297
49	17	19.33	0.31007
50	17	10.51	0.88101
51	17	9.42	0.92621
52	17	12.35	0.77879
53	17	28.20	0.04264
54	17	15.05	0.59214
55	17	9.48	0.92407
56	17	26.08	0.07298
57	17	21.35	0.21094
58	17	17.89	0.39612
59	17	20.46	0.25128
60	17	18.57	0.35387
61	17	22.90	0.15244
62	17	26.85	0.06035
63	17	14.48	0.63269
64	17	18.39	0.36464
65	17	15.45	0.56338
66	17	11.34	0.83818
67	17	11.04	0.85460
68	17	9.00	0.94030
69	17	18.88	0.33551

Test No.	DOF	ChiSqr	P-Value
70	17	15.21	0.58015
71	17	21.85	0.19044
72	17	23.77	0.12587
73	17	34.15	0.00802
74	17	13.84	0.67842
75	17	14.89	0.60344
76	17	16.07	0.51865
77	17	18.84	0.33754
78	17	16.71	0.47428
79	17	19.19	0.31755
80	17	20.21	0.26364
81	17	11.02	0.85572
82	17	12.71	0.75558
83	17	12.22	0.78673
84	17	7.29	0.97954
85	17	13.17	0.72465
86	17	20.71	0.23968
87	17	8.16	0.96295
88	17	19.10	0.32258
89	17	20.29	0.25975
90	17	19.83	0.28309
91	17	12.04	0.79762
92	17	7.24	0.98028

Test No.	DOF	ChiSqr	P-Value
93	17	19.72	0.28868
94	17	18.15	0.37925
95	17	22.06	0.18256
96	17	15.43	0.56434
97	17	21.20	0.21742
98	17	13.78	0.68227
99	17	13.26	0.71831
100	17	20.99	0.22667
Combined P-Value for 100 tests (Using KS method)			0.36652

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	61.94	0.11985
2	50	69.40	0.03602
3	50	43.32	0.73670
4	50	41.55	0.79673
5	50	52.56	0.37504
6	50	43.34	0.73577
7	50	34.59	0.95227
8	50	36.78	0.91800
9	50	48.16	0.54736
10	50	54.34	0.31277
11	50	34.27	0.95618

Test No.	DOF	ChiSqr	P-Value
12	50	40.91	0.81682
13	50	68.70	0.04071
14	50	32.97	0.96984
15	50	35.04	0.94623
16	50	43.49	0.73039
17	50	32.95	0.96999
18	50	47.55	0.57213
19	50	59.49	0.16829
20	50	52.87	0.36398
21	50	49.48	0.49417
22	50	60.28	0.15144
23	50	43.58	0.72732
24	50	43.05	0.74607
25	50	48.85	0.51960
26	50	70.26	0.03092
27	50	41.76	0.79007
28	50	48.48	0.53465
29	50	63.31	0.09784
30	50	36.62	0.92102
31	50	48.11	0.54939
32	50	52.10	0.39225
33	50	64.60	0.08023
34	50	50.42	0.45694

Test No.	DOF	ChiSqr	P-Value
35	50	57.96	0.20524
36	50	43.51	0.72986
37	50	42.44	0.76739
38	50	52.16	0.38999
39	50	64.09	0.08690
40	50	45.61	0.64986
41	50	57.57	0.21553
42	50	46.94	0.59702
43	50	38.36	0.88519
44	50	43.86	0.71687
45	50	55.02	0.29051
46	50	26.39	0.99759
47	50	18.65	0.99998
48	50	37.25	0.90909
49	50	42.10	0.77887
50	50	47.94	0.55658
51	50	30.19	0.98804
52	50	56.00	0.25998
53	50	44.31	0.70019
54	50	40.75	0.82167
55	50	49.50	0.49338
56	50	66.36	0.06054
57	50	36.82	0.91740

Test No.	DOF	ChiSqr	P-Value
58	50	37.41	0.90579
59	50	61.49	0.12782
60	50	53.91	0.32711
61	50	29.61	0.99035
62	50	51.85	0.40164
63	50	52.74	0.36869
64	50	73.82	0.01588
65	50	45.55	0.65252
66	50	42.38	0.76941
67	50	55.34	0.28014
68	50	57.73	0.21115
69	50	48.18	0.54676
70	50	53.19	0.35224
71	50	57.16	0.22655
72	50	51.79	0.40394
73	50	44.29	0.70099
74	50	50.18	0.46632
75	50	43.44	0.73215
76	50	58.78	0.18488
77	50	58.97	0.18043
78	50	46.25	0.62477
79	50	42.79	0.75543
80	50	52.33	0.38375

Test No.	DOF	ChiSqr	P-Value
81	50	31.92	0.97823
82	50	67.90	0.04677
83	50	42.53	0.76423
84	50	48.18	0.54659
85	50	44.99	0.67437
86	50	46.06	0.63225
87	50	45.50	0.65441
88	50	47.77	0.56337
89	50	42.44	0.76734
90	50	57.61	0.21425
91	50	38.86	0.87321
92	50	47.49	0.57476
93	50	38.07	0.89167
94	50	58.33	0.19589
95	50	38.83	0.87383
96	50	44.04	0.71010
97	50	52.37	0.38201
98	50	44.85	0.67950
99	50	37.03	0.91328
100	50	55.55	0.27354
Combined P-Value for 100 tests (Using KS method)			0.12280

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	24.44	0.01770
2	12	13.18	0.35615
3	12	12.07	0.43999
4	12	11.31	0.50265
5	12	14.34	0.27926
6	12	5.49	0.93956
7	12	15.62	0.20923
8	12	16.22	0.18120
9	12	14.46	0.27203
10	12	6.52	0.88788
11	12	6.21	0.90489
12	12	5.71	0.93019
13	12	4.52	0.97207
14	12	12.93	0.37383
15	12	18.73	0.09536
16	12	3.95	0.98432

Test No.	DOF	ChiSqr	P-Value
17	12	11.43	0.49258
18	12	14.35	0.27901
19	12	11.34	0.50006
20	12	6.32	0.89914
21	12	12.53	0.40416
22	12	12.98	0.37055
23	12	13.25	0.35084
24	12	11.78	0.46318
25	12	12.25	0.42585
26	12	13.82	0.31267
27	12	8.85	0.71562
28	12	9.20	0.68571
29	12	6.71	0.87636
30	12	9.18	0.68748
31	12	4.13	0.98101
32	12	11.86	0.45721
33	12	10.59	0.56438
34	12	9.30	0.67747
35	12	19.89	0.06914
36	12	7.59	0.81623
37	12	6.44	0.89222
38	12	10.19	0.59963
39	12	11.16	0.51533
40	12	16.76	0.15893

Test No.	DOF	ChiSqr	P-Value
41	12	10.88	0.53900
42	12	9.96	0.61926
43	12	13.33	0.34559
44	12	5.28	0.94799
45	12	11.15	0.51579
46	12	11.33	0.50099
47	12	8.95	0.70740
48	12	11.69	0.47061
49	12	8.20	0.76938
50	12	7.94	0.78999
51	12	5.58	0.93568
52	12	6.68	0.87796
53	12	4.79	0.96470
54	12	12.48	0.40766
55	12	15.12	0.23486
56	12	20.08	0.06552
57	12	8.54	0.74161
58	12	12.83	0.38167
59	12	13.60	0.32671
60	12	9.40	0.66865
61	12	22.01	0.03736
62	12	14.34	0.27958
63	12	5.87	0.92260
64	12	6.06	0.91290

Test No.	DOF	ChiSqr	P-Value
65	12	14.66	0.26048
66	12	11.41	0.49410
67	12	20.16	0.06405
68	12	9.09	0.69487
69	12	22.19	0.03541
70	12	14.01	0.30029
71	12	36.68	0.00025
72	12	18.45	0.10260
73	12	24.09	0.01980
74	12	22.38	0.03350
75	12	22.96	0.02805
76	12	8.79	0.72102
77	12	6.07	0.91258
78	12	8.90	0.71122
79	12	19.56	0.07592
80	12	8.16	0.77284
81	12	7.07	0.85289
82	12	12.50	0.40663
83	12	18.45	0.10273
84	12	12.78	0.38506
85	12	16.01	0.19099
86	12	17.28	0.13947
87	12	8.46	0.74836
88	12	4.25	0.97843

Test No.	DOF	ChiSqr	P-Value
89	12	10.85	0.54199
90	12	20.43	0.05937
91	12	10.25	0.59404
92	12	15.94	0.19396
93	12	8.00	0.78551
94	12	7.42	0.82855
95	12	12.73	0.38907
96	12	14.65	0.26103
97	12	6.93	0.86231
98	12	6.98	0.85886
99	12	8.24	0.76603
100	12	12.20	0.42994
Combined P-Value for 100 tests (Using KS method)			0.81160

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	10.41	0.58009
2	12	10.91	0.53630
3	12	20.46	0.05888
4	12	9.38	0.67060
5	12	8.96	0.70676
6	12	13.11	0.36091
7	12	10.75	0.55040

Test No.	DOF	ChiSqr	P-Value
8	12	9.80	0.63378
9	12	10.86	0.54134
10	12	13.95	0.30368
11	12	15.76	0.20241
12	12	17.05	0.14779
13	12	12.27	0.42418
14	12	5.68	0.93153
15	12	12.57	0.40100
16	12	10.29	0.59068
17	12	14.73	0.25656
18	12	6.22	0.90458
19	12	10.08	0.60919
20	12	14.66	0.26077
21	12	4.58	0.97048
22	12	7.98	0.78643
23	12	10.01	0.61547
24	12	19.43	0.07862
25	12	11.51	0.48569
26	12	13.07	0.36383
27	12	9.13	0.69174
28	12	15.39	0.22063
29	12	8.90	0.71119
30	12	14.27	0.28367

Test No.	DOF	ChiSqr	P-Value
31	12	12.30	0.42201
32	12	10.39	0.58165
33	12	8.19	0.76981
34	12	9.43	0.66580
35	12	15.49	0.21577
36	12	14.75	0.25522
37	12	14.02	0.29963
38	12	15.40	0.22046
39	12	14.62	0.26294
40	12	15.16	0.23284
41	12	6.35	0.89764
42	12	17.93	0.11768
43	12	10.84	0.54295
44	12	11.92	0.45246
45	12	13.81	0.31270
46	12	11.66	0.47330
47	12	7.80	0.80033
48	12	15.26	0.22761
49	12	18.45	0.10279
50	12	15.41	0.21988
51	12	8.74	0.72457
52	12	5.18	0.95187
53	12	14.38	0.27729

Test No.	DOF	ChiSqr	P-Value
54	12	14.35	0.27906
55	12	11.47	0.48888
56	12	10.44	0.57746
57	12	20.86	0.05243
58	12	7.37	0.83223
59	12	10.86	0.54092
60	12	21.73	0.04071
61	12	8.19	0.77040
62	12	14.40	0.27582
63	12	13.87	0.30888
64	12	10.25	0.59381
65	12	6.39	0.89488
66	12	8.68	0.72962
67	12	9.24	0.68207
68	12	13.40	0.34052
69	12	9.34	0.67384
70	12	9.01	0.70198
71	12	7.49	0.82348
72	12	18.66	0.09702
73	12	13.74	0.31795
74	12	14.19	0.28859
75	12	8.15	0.77299
76	12	21.69	0.04112
77	12	16.46	0.17113

Test No.	DOF	ChiSqr	P-Value
78	12	10.19	0.59915
79	12	19.76	0.07185
80	12	9.10	0.69439
81	12	19.32	0.08118
82	12	6.00	0.91623
83	12	11.23	0.50904
84	12	13.96	0.30321
85	12	13.45	0.33728
86	12	9.63	0.64846
87	12	10.95	0.53317
88	12	17.88	0.11934
89	12	5.24	0.94939
90	12	8.78	0.72135
91	12	16.77	0.15859
92	12	14.12	0.29335
93	12	6.38	0.89578
94	12	7.81	0.79986
95	12	19.50	0.07720
96	12	9.67	0.64515
97	12	20.32	0.06133
98	12	18.23	0.10889
99	12	15.61	0.20968
100	12	16.45	0.17139
Combined P-Value for 100 tests (Using KS method)			0.34937

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)	0.10183	0.50913
Opening Score (Dealer)	0.36652	1.00000
Dealer's Final Score	0.12280	0.50913
Player Cards Rank	0.81160	1.00000
Dealer Cards Rank	0.34937	1.00000
Combined P-Value using Holm's Method		0.50913

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.

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.

GLI has done limited sanity checks to verify the integrity of the game logs. GLI 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 note, the results contained herein are based on game design documentation provided to GLI by the manufacturer. It is the responsibility of the manufacturer to ensure that the gaming software performs in the same way as the documentation.

Please visit Gaminglabs.com to view the applicable Terms and Conditions and GLI Product Certification Scheme.

Should you have any questions or need any additional information, please feel free to contact our office.

Sincerely,

GAMING LABORATORIES INTERNATIONAL, LLC



Christine M. Gallo

Senior Vice President, Quality and Technical Compliance