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**Report Type** Evaluation and Certification

**Report Date** 16 September 2020

**Issuing Laboratory** GLI Europe B.V.

**Evaluating Laboratory** GLI Europe B.V.

**Recipient** Evoplay Entertainment BV  
Fransche Bloemweg, 4  
Curaçao  
UK Remote:

- Remote Gambling and Software Technical Standards (June 2017).
- Testing Strategy for Compliance with Remote Gambling and Software Technical Standards November 2018.

**Tested against Requirements**

Malta Online:

- L.N. 243 of 2018 - GAMING ACT (CAP. 583) Gaming Authorisations Regulations, 2018.
- Directive 2 of 2018 - Player Protection Directive.

**Jurisdiction** UK Remote  
Malta Online

**Manufacturer** Evoplay Entertainment BV  
Fransche Bloemweg, 4  
Curaçao

**Submitter** Evoplay Entertainment BV  
Fransche Bloemweg, 4  
Curaçao

**Product Name** RNG Random, version 1.0

mafia\random.php, journeytothewest\random.php, et\random.php, epicgladiators\random.php, elvenprincesses\random.php, charmingqueens\random.php, candydreams\random.php, aceround\random.php, necromancer\random.php, robots\random.php, Atlantis\Random.php, ClashOfPirates\Random.php, EgyptGods\Random.php, EmperorsTomb\Random.php, IndianasQuest\Random.php, LegendOfRa\Random.php, RobinHood\Random.php, TalismansOfFortune\Random.php, TheGreatConflict\Random.php, VegasNights\Random.php, common\Random.php

As requested per submitter's letter received 19 May 2020.

**Description of the Product Tested**

**Evaluation Period** 22 May 2020 / 9 June 2020

**Internal Reference** RN-246-EVP-20-01, RN-246-EVP-20-01-246

**Result** Pass (See Comments and Conditions on the following pages)

**Internal methods used reference** Random Number Generator (RNG) Analysis  
WI-MA-006, PC-TC-001

**Technical Evaluation authorized by:**

Martin Britton  
Managing Director

FM-QA-077

Template Revision Date: 19 March 2020





## RANDOMNESS REPORT FOR THE RNG RANDOM

This Revised Report replaces Evaluation Report RN-246-EVP-20-01\_B\_1 dated 23 June 2020.

This Revised Report was issued in order to:

- update the "Range" for Data Set "Binary for DieHard" from 0- 2,147,483,6487 to 0- 2,147,483,647 in the "Table 2. Game Parameters" on page 7 of this Report.

The intent of this report is to indicate that **Gaming Laboratories International, LLC** (GLI) has completed its evaluation of the RNG Random random number generator (RNG), version 1.0, provided by Evoplay Entertainment BV.

### SECTION I - SCOPE OF TESTING

Evoplay Entertainment BV submitted the required materials to GLI in order to conduct a random number generator analysis on the RNG Random. The scope of this analysis was limited to software verification, source code review, and data analysis. The RNG was tested for its ability to randomly produce outcomes for the Slots, Poker, BlackJack, Baccarat, Roulette and Instant games.

The RNG Random was evaluated against the RNG-specific requirements of the following technical standards:

- UK Remote
  - Remote Gambling and Software Technical Standards (June 2017).
  - Testing Strategy for Compliance with Remote Gambling and Software Technical Standards November 2018.
- Malta Online
  - L.N. 243 of 2018 - GAMING ACT (CAP. 583) Gaming Authorisations Regulations, 2018.
  - Directive 2 of 2018 - Player Protection Directive.

The software being certified herein is a cryptographically strong RNG (CSRNG) without background cycling. CSRNGs do not need to implement background cycling to improve their unpredictability and resistance to attack. As a consequence, they meet and exceed the intent of traditional background cycling requirements, but through mechanisms other than background cycling





## RANDOMNESS REPORT FOR THE RNG RANDOM

### SECTION II - SOFTWARE VERIFICATION

Verify+ by Kobetron™ signatures for the RNG Random are as follows:

File	Version	Type	Signature
mafia\random.php	1.0	Kobe4	C911
		MD5	BD04474BDE70B591FAC7D9E23DBFDD8B
		SHA-1	1F88ADB1DEA6DD61F55ADB26F2DB7BA88E29A564
		Kobe40	6C9F3F9F60487153623HP03UP768FA4HUCPUA373
		CDCK	A997
journeytothewest\random.php	1.0	Kobe4	225U
		MD5	BBD088F58A3B00F3CD7FB95999B85B37
		SHA-1	CFDFB029724294058C7E31198B90C5AFE51E20E9
		Kobe40	H254C30H37CF3U4F2P737AUF8F5266CUF98F7CA5
		CDCK	6EF5
et\random.php	1.0	Kobe4	83H4
		MD5	7148D0A90ED9EDD171CCB36582D46784
		SHA-1	1E8DF6E9AD4398D2128878349AC1260E03C10425
		Kobe40	F9U4F19C9U08067U3780U624A8UP7CH8F381373F
		CDCK	8524
epicgladiators\random.php	1.0	Kobe4	5359
		MD5	89148F80D2CCEFAB0F67F8F55FC78C38
		SHA-1	91668E852EF8D8C998162DEBF8887858341E4634
		Kobe40	789A40CH9224206C13U7HF3C00889PC5885H7PU0
		CDCK	626F
elvenprincesses\random.php	1.0	Kobe4	U328
		MD5	EE75E6055F18EEA5AA754811800CD436
		SHA-1	67EBA53FA75F9E6AA2757B60CFBD8A6F09E3C18A
		Kobe40	3C096F335P8UH531U55H196UAACH69F45H90C107
		CDCK	8A0F
charmingqueens\random.php	1.0	Kobe4	30AF
		MD5	9AB68244D24108009B646E92D69DAEC2
		SHA-1	45C524130C59478A25F4E3E7D051AE6254ABD6D9
		Kobe40	F4C61P85FAFC694F8FAP35F0HU29448H2FA97PPH
		CDCK	03D3





## RANDOMNESS REPORT FOR THE RNG RANDOM

### SECTION II - SOFTWARE VERIFICATION

Verify+ by Kobetron™ signatures for the RNG Random are as follows (continued):

File	Version	Type	Signature
candydreams\random.php	1.0	Kobe4	8PHH
		MD5	9657C1C84CACF10DDBFCC197702CC6D8
		SHA-1	A3EBF0D2E90DC8A95DA692563CE957676FA6D7F0
		Kobe40	UH6H9CH3C2FP25H3F7H2HPA494906F08ACU66U9C
		CDCK	CC31
aceround\random.php	1.0	Kobe4	03C9
		MD5	E57ACD904F05F6032D2602E619BAD793
		SHA-1	EF66DAF55585C9B60FBA0A209917FEE5BBD4937
		Kobe40	PH76H3UC54033673P5C9460A2UF86FC3F8AC9H7U
		CDCK	6766
necromancer\random.php	1.0	Kobe4	7PU7
		MD5	9E8618A7782FF1172FC54ECAB3236918
		SHA-1	FC81FA358FDCFAA870102EBC46B16AC31D7663AA
		Kobe40	280UC10ACUF86C9PP26PPHC5H111C456H3P55493
		CDCK	BB15
robots\random.php	1.0	Kobe4	PC8C
		MD5	B7E8A9C2120391DA06690FF1DF31C7A5
		SHA-1	E8F4F1C97F5FC6E2408B9D5010F5B685F716890C
		Kobe40	102PUCA46527C7CF30920794FF31UP212037HHC4
		CDCK	734E
Atlantis\Random.php	1.0	Kobe4	A36F
		MD5	CDC78E1E737D62031766695E862F3656
		SHA-1	27576D46F022C138FCF8DBF2166B8972483069ED
		Kobe40	3H81UH90862HA60178C634A2U2P8A86U6A7U5U38
		CDCK	52E2
ClashOfPirates\Random.php	1.0	Kobe4	56PP
		MD5	9C37FC1635F1DD65FC06104C82EAE876
		SHA-1	2E7064E85C724CD9B6749095B6FC40B1E39FBFB9
		Kobe40	47963709F857HHF8324FH7F067863FP121741746
		CDCK	D636





## RANDOMNESS REPORT FOR THE RNG RANDOM

### SECTION II - SOFTWARE VERIFICATION

Verify+ by Kobetron™ signatures for the RNG Random are as follows (continued):

File	Version	Type	Signature
EgyptGods\Random.php	1.0	Kobe4	2C41
		MD5	85D75807BB9BEC95C1AC3FBCD184360E
		SHA-1	A6C2B275BDDBB16280D02846E5CB88DC0FEC9AB3
		Kobe40	4HUH71F5086U470U4851UUPC5A3UP2A8HUPA2C20
		CDCK	0E71
EmperorsTomb\Random.php	1.0	Kobe4	9647
		MD5	FB8E7D952143C6A5EDFF03D0BD76E041
		SHA-1	9B0EF0B6CF9110F7030A7E8B4BB33500541EF56E
		Kobe40	H1U1230184AF4U2C1U6UU53A6966CP4CPC99968C
		CDCK	FD7B
IndianasQuest\Random.php	1.0	Kobe4	H061
		MD5	7DB955B40C8712E28B11C3D4A41B639D
		SHA-1	7BE3888CA0F147DC29FE50A7A50FB3BB281989C3
		Kobe40	53PA225AA587P3HA08930A55C261CA9201H40U89
		CDCK	2D02
LegendOfRa\Random.php	1.0	Kobe4	541U
		MD5	D0D0CD824A4676731315E64188393A90
		SHA-1	BF210C97175ABA15E414A6B7E866165442E2C77A
		Kobe40	1CF94C3PU5C90HCPA628A8HA452CFCC7289HF622
		CDCK	D981
RobinHood\Random.php	1.0	Kobe4	5510
		MD5	7110B424010D2487AD4FFC86EA800E20
		SHA-1	76901E8ED1073C43BE529659F6ED2BB6EE4E34F3
		Kobe40	1C06PP332U7238HHH39U28PF1H61C6111F65UAU9
		CDCK	3085
TalismansOffortune\Random.php	1.0	Kobe4	79AP
		MD5	C9FC89E6DA02863FB3566740F14A7616
		SHA-1	D49F77B3BEC4030392535E977ADBE27A4598EF5F
		Kobe40	CUPH2HP63822U71F79CC2F82U8U0FA2U2153PA81
		CDCK	EDEF



## RANDOMNESS REPORT FOR THE RNG RANDOM

### SECTION II - SOFTWARE VERIFICATION

Verify+ by Kobetron™ signatures for the RNG Random are as follows (continued):

File	Version	Type	Signature
TheGreatConflict\Random.php	1.0	Kobe4	07U8
		MD5	65413B485E44F225C1D1BD39EF4B98E4
		SHA-1	2A99F2225DC9AC6FFC8A7F255F5BFAFDBEDB635F
		Kobe40	541PA2PH227867C4ACCAH44115AHAU532HFU65CC
		CDCK	3AF8
VegasNights\Random.php	1.0	Kobe4	6F73
		MD5	AA1B7594B350AA393CDA7B42EE34E606
		SHA-1	FD736ABC59FD47A6870981B53BA39A78CB238A47
		Kobe40	8UU754958UH6243846P25UP7UF18866H5F8820PF
		CDCK	0735
common\Random.php	1.0	Kobe4	U39H
		MD5	9293582C699191C4A4FAF1DA1584C169
		SHA-1	294F0710CACD8D048DE6C3855A5DE0455F5C313D
		Kobe40	6686557AU1A7520APA73557U880361F764699C2U
		CDCK	9007

Table 1. Digital Signatures

### SECTION III - SOURCE CODE REVIEW

Evoplay Entertainment BV submitted appropriate documentation and FULL source code which pertains to the generation of random numbers. GLI reviewed the source code provided by tracing the path of the RNG application from the initiation of the draw to the selected output of random numbers. GLI inspected the source code, where practicable, in an attempt to find any undisclosed switches or parameters having a possible influence on randomness and fair play. GLI assessed the ability of the RNG to produce all numbers within the desired range.



## RANDOMNESS REPORT FOR THE RNG RANDOM

### SECTION IV - DATA ANALYSIS

The game configuration and parameters for the data obtained and tested are listed in Table 2. GLI performed a data format check on each data set listed in order to confirm that the game parameters were correctly represented in the data analyzed.

GLI conducted a statistical analysis of sufficient scope to test the RNG in the case of Slot games for selecting as many as 15 winners from a pool size as large as 2,001 as described in Table 2. The selection of test cases took into account broad coverage of range sizes and selections. A set of numbers is said to be drawn *with replacement* if a number can be selected multiple times within the same draw. A set of numbers is said to be drawn *without replacement* if a number can only be selected once within the same draw.

Data Set	Range	Positions	Replacement	Draws
Slots	Up to and including 0-2,000	1 to 15	Yes	①
Poker	0-51	52	No	50,000,000
BlackJack	0-311	312	No	10,000,000
Baccarat	0-415	416	No	5,000,000
Roulette	0-37	1	N/A	50,000,000
Instant	1-100	100	Yes	20,000,000
Binary for DieHard	0- 2,147,483,647	1	N/A	3,096,775

**Table 2.** Game Parameters

① Data sets of different ranges and draw sizes were collected and analyzed to cover the scope of this general certification.

For a summary of the statistical tests applied to each data set, see *Appendix A*. For a description of the overall test methodology and a description of each test used, see *Appendix B*.

Overall, the RNG passed the battery of tests for each configuration at the 95%, 98% and 99% confidence levels.

### SECTION V - SUMMARY

#### Overall Evaluation of the Random Number Generator

GLI’s conclusion based upon the tests applied to the RNG Random data is that this random number generator has exhibited random behavior and is suitable for the applications as described herein. If a game utilizes a different range or a different number of selections from the included ranges, the RNG should be resubmitted to test that set of parameters.



## APPENDIX A: Statistical Test Summary

Data Set	Range	Positions	Replacement	Draws	Test Names												
					Runs	Serial Corr.	Interplay Corr.	Adj. Max-Min	Adj. High-Low	Adj. Blocks	Coupon	Duplicates	Overlaps	Permutation	Tot. Dist.	Tot. Dist. by Pos.	Count of Counts
Slots	Up to and including 0-2,000	1 to 15	Yes	①	X	X	X	X	X		X	X	X		X	X	X
Poker	0-51	52	No	50,000,000	X	X	X	X	X	X		X	X	X	X	X	
BlackJack	0-311	312	No	10,000,000	X	X	X	X	X	X		X	X	X	X	X	
Baccarat	0-415	416	No	5,000,000	X	X	X	X	X	X		X	X	X	X	X	
Roulette	0-37	1	N/A	50,000,000	X	X					X	X	X		X		
Instant	1-100	100	Yes	20,000,000	X	X	X	X			X	X	X		X	X	
Binary for DieHard	0-2,147,483,647	1	N/A	3,096,775													X

Table A.1. Tests Applied

① Data sets of different ranges and draw sizes were collected and analyzed to cover the scope of this general certification.





## APPENDIX B: Test Descriptions

**B.1 Definitions.** The following terms apply to the below test descriptions. Randomness Device or Random Number Generator (RNG) output may be collected multiple numbers at a time. Each set of numbers is called a draw. Each individual number has a particular order within the *draw*. This is referred to as the number *position*.

**B.2 Distribution Comparisons.** Many of the tests compare an observed numerical distribution with an expected distribution. Unless otherwise specified, this is done by means of a statistical chi-square goodness-of-fit test. The value chi-square is computed in the standard way. If  $k$  is a possible value,  $o_k$  is the observed count of that value, and  $e_k$  is the expected count:

$$\chi^2 = \sum_k \frac{(o_k - e_k)^2}{e_k}$$

In the case where expected counts are too small for accurate use of the above formula, values are 'binned' together to ensure an appropriate minimum expected count. The resultant value for chi-square is compared against the distribution for the appropriate number of degrees of freedom. Unusually high (distribution mismatch) or unusually low (insufficient randomness) chi-square values can be causes for data failure.

**B.3 Meta-testing.** Evaluation of groups of  $p$ -values may include a meta-test for extremity of high or low  $p$ -values, a meta-test for frequency of high or low  $p$ -values, and a meta-test for uniformity of  $p$ -values, as appropriate.

**B.4 Confidence Level.** The statistical tests conducted by GLI are done at a particular *confidence level*. Common confidence levels used include 95%, 98%, and 99%, depending on jurisdictional requirements, and intended use of the RNG. High confidence level testing has low risk of mistakenly failing a good RNG, but higher risk of passing a bad RNG. Lower confidence level testing has increased power of detecting bad RNGs, while also increasing the risk of false failures of good RNGs. Specifically, the confidence level represents the probability that an ideal source of randomness would pass the testing. If an RNG passes statistical tests at a given confidence level, passage at all *higher* confidence levels is implied.

**B.5 Tests.** Some tests are only applicable to certain types of data. Some tests may be applied only to a portion of the data. Some tests may require that the data be parsed, binned, or otherwise transformed, as necessitated by data format.



## APPENDIX B: Test Descriptions

### Adjacency Blocks:

For each draw, the data is first sorted. Then the amount of contiguous blocks of numbers is counted. These statistics are then compared against the expected. For example, if a draw consists of the numbers

1, 5, 4, 2, 6, 9

the data would be sorted and separated into blocks. The resulting statistic would be 3.

### Adjacency High-Low:

For each draw, the number of local extrema ('highs' and 'lows') in the data is recorded and compared with the expected distribution. These are also referred to as 'turning points'. For example, if a draw consists of the numbers

1, 3, 5, 7, 2, 9

there would be one local maximum (7) and one local minimum (2). The resulting statistic would be 2.

### Adjacency Max-Min:

For each draw, the difference between the maximum and minimum values is calculated and recorded. This is compared with the expected theoretical distribution. For example, if a draw consists of the numbers

2, 3, 6, 7, 4

the resulting statistic would be 5, the difference between the maximum value (7) and the minimum value (2).

### Count of Counts:

The Count of Counts test first counts the occurrences of each value in each position of the data. These counts are then tallied and compared with the expected distribution of counts for the draw size and range of values.

### Coupon Collector's:

The Coupon Collector's Test is applied positionally. The data is parsed until all possible values have been observed, then the number of values checked is recorded and the count is restarted. This is compared with the expected distribution. For example, if the set of all possible values is {0, 1, 2} and the first position of each draw is

1, 0, 1, 0, 2, 0, 1, 2, ...

then all values are observed in the first position by the fifth draw. All values are then observed within the next 3 draws, so the first two statistics for the first position would be 5 and 3.

### DieHard:

The DieHard Battery of Tests is a standard assessment of the randomness in raw outcomes generated from an RNG. The collection, designed by George Marsaglia, tests for a variety of patterns in the individual binary bits of RNG output. GLI uses a custom implementation to conduct DieHard testing.



## APPENDIX B: Test Descriptions

### Duplicates:

The Duplicates Test counts the number of times a draw is exactly duplicated in the data. In the case that a particular draw is repeated more than twice, every possible way to generate a duplicate is counted. This is compared against the theoretical distribution to verify that the number of duplicate draws falls within expected bounds. For example, consider the dataset consisting of the following draws of two numbers each.

a) 1, 3

b) 4, 1

c) 1, 3

d) 1, 3

e) 4, 1

f) 3, 1

The duplicate pairs are  $(a, c)$ ,  $(a, d)$ ,  $(c, d)$ , and  $(b, e)$ , for a total of 4 duplicates.  $(f)$  is not counted as a duplicate since the draw must match in order as well as values.

### Interplay Correlation:

The Interplay Correlation Test measures statistical correlation between different positions of the same draw. For each pair of positions, statistical correlation is calculated as in the Serial Correlation Test. In the case of without replacement data, an adjustment is made to account for the expected resulting negative correlation.

### Overlaps:

The Overlaps Test compares consecutive draws for overlapping values. The number of overlapping values is recorded for each pair of draws. This observed distribution of overlaps is then compared against the expected distribution. For example, if the following draws are observed consecutively,

a) 1, 4, 5, 6

b) 4, 1, 7, 6

the number of overlaps would be 3, representing the values 1, 4, and 6.

### Permutation:

The Permutation Test is a test applicable to data that represents a reordering of numbers. Each draw can be considered as a permutation of the original ordering. Every permutation can be decomposed into disjoint cycles, which represent the possible positions a number would occupy if the same permutation is applied repeatedly. For each draw, three statistics are collected based on the cycle decomposition:

The number of cycles.

The size of the smallest cycle.

The size of the largest cycle.

Each of these statistics generates a distribution of observations which are compared with their respective expected distributions. For example, if the following draw were observed as a reordering of the numbers from 1 to 6,

1, 3, 5, 4, 2, 6

the cyclic decomposition would be  $(1)(2\ 3\ 5)(4)(6)$ . 1, 4, and 6 remain in their original positions, so they form their own cycles. The values 2, 3, and 5 are shuffled, so they form a single cycle together. The total number of cycles is 4, the smallest cycle has size 1, and the largest cycle has size 3.



## APPENDIX B: Test Descriptions

### Runs:

The Wald-Wolfowitz Runs Test is applied to each position within the draw. A center is established, typically the data median, and the number of 'runs' above and below the center are tallied. Values exactly equal to the center are discarded. This is compared to the expected distribution, which depends on the number of values above and below the center. For example, if the numbers drawn at a particular position were

2, 3, 1, 5, 4, 7, 3, 2, 3, 2, 3, 2, 6, 7, 3, 5

and the established center were the data median of 3, the data would be parsed for runs above 3 and runs below 3.

2, 3, 1      2, 3, 2, 3, 2  
 ⤴      ⤴      ⤴      ⤴  
 ⤵      ⤵      ⤵      ⤵  
 '5, 4, 7, 3'      '6, 7, 3, 5'

This would be counted as 4 runs.

### Serial Correlation:

The Serial Correlation Test measures statistical correlation between consecutive draws of the same position. For each position, the sample Pearson correlation coefficient is calculated. If  $X$  represents the first number, and  $Y$  the number that follows, then the coefficient is

$$r = \frac{cov(X, Y)}{s_X s_Y}$$

where  $s$  denotes the sample standard deviation. The coefficients are used to generate a  $p$ -value for each position.

### Total Distribution:

The Total Distribution Test is a simple tally of all observed values throughout the data. This is compared with the expected distribution. Typically, the expected distribution is a uniform distribution. In the case of unequal weighting of values, an appropriate discrete distribution is used.

### Total Distribution by Position:

The Total Distribution by Position Test tallies the observed distribution of values for each position within the draw. Each of these distributions is then compared with the expected.



## Jurisdictional Requirements

GLI’s evaluation to the Technical Standard was limited only to the requirements applicable to the {RNG Random, version 1.0}. In addition, the following sections of the applicable Technical Standard were excluded from the scope of work for this evaluation:

### United Kingdom – Remote

Technical Standard Section(s)	Reason for Exclusion
7A - Where lotteries use the outcome of other events external to the lottery, to determine the result of the lottery the outcome must be unpredictable and externally verifiable.	Not a lottery
7A.b - For lotteries using external events - where it is not practical to demonstrate 7a.	Not a lottery
7A.c - For games or virtual events that use the laws of physics to generate the outcome of the game (mechanical RNGs), the mechanical RNG used should be capable of meeting the requirements in a. where applicable and in addition:	Not a mechanical RNG
7A.d - Restricting adaptive behavior prohibits automatic or manual interventions that change the probabilities of game outcomes occurring during play. Restricting adaptive behavior is not intended to prevent games from offering bonus or special features that implement a different set of rules, if they are based on the occurrence of random events.	RNG Evaluation only

### Malta Online

Technical Standard Section(s)	Reason for Exclusion
All, except requirements directly referring to Random Numbers Generators.	RNG Evaluation only

