

Basic statistical test of bit sequences

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Date/Time: 2.08.2002,17:59 hour

file: p3.dat size: 10000000 Bytes

Test of null-hypothesis:

Bit stream ist a stream of truly randomly drawn number 0,1 with same probability $p = 0.5$

Non-overlapping byte count:

00	38540	39146	39277	38993	39422	39032	39285	39234
08	39312	38943	38642	39022	39154	39195	39030	38630
10	39020	38721	39039	39122	39258	39074	38885	38864
18	38912	38847	38804	38644	39100	39041	39261	39284
20	39019	38812	39034	39156	39076	39007	39270	39244
28	38646	39439	39093	38918	39008	38949	38981	39030
30	38817	39084	38870	39059	38835	39423	39035	38923
38	39222	39182	38793	39128	39108	39186	38888	39431
40	39318	38962	39130	39260	38919	39284	39412	39150
48	39065	38984	38489	39366	39089	38858	39287	38630
50	39085	38771	39069	39064	39273	38974	39034	39247
58	39199	38824	38800	38552	38910	39029	39065	39213
60	39014	38997	39051	39016	38973	38981	38941	38712
68	39046	39082	38777	39228	39223	39091	38981	39052
70	38942	39084	39314	38880	39347	39186	39088	39178
78	39149	39266	39292	39443	38703	39014	39066	39424
80	38995	39299	38829	38981	38837	39121	39153	38998
88	39232	39098	39055	39117	38837	39108	39058	39183
90	38985	38973	39128	39129	39111	39150	39097	39012
98	38951	39119	39123	39064	38927	39225	39041	39162
a0	39092	38994	39096	39458	39453	39285	38628	38872
a8	39243	39056	39059	39038	38829	39184	39417	39059
b0	39083	39159	38813	38921	39394	39257	38765	38966
b8	39084	38972	39319	39297	38892	39124	38995	39186
c0	39113	39151	39019	38944	39200	39215	38946	38822
c8	39182	39010	39380	39450	39093	39142	39119	39369
d0	38951	39238	38950	38973	39074	39307	39371	39168
d8	38796	38734	38901	39252	38946	39031	39337	38772
e0	38948	39000	39019	38857	39487	38809	39029	39212
e8	38978	38816	38945	39170	39177	38821	38936	39069
f0	39286	39143	39263	38767	38981	39420	38846	38736
f8	39219	39271	38878	39178	39457	39046	39078	38862

Evaluation of count of 10000000 Bytes = 80000000 Bits:

Theoretical average of byte-frequencies: 39062

'4a' = 38489 (minimum) 'e4' = 39487 (maximum)

Theoretical interval I of byte-frequencies:

I = (38676 to 39449) (for 95 % of 256 frequency)

Test 1:

The theoretical permissible number of the 5% outliers (average 13) from the interval I is between 6 and 20

The real number of the outliers from interval I:

smaller: 9 greater: 5 summary: 14

Test 2:

Evaluation of byte-frequencies

Chi-square non-overlapping:

Theoretical maximum chi-square = 293.25
Chi-square value = 246.51

Chi-square overlapping:

Theoretical maximum chi-square = 155.40
Chi-square value = 134.50

Test 3:

r = 0.50006169 (relative frequency of bit 1 in the bit stream)

For a truly random sequence, the probability for r to have values in the complement of the open interval (0.49993831 , 0.50006169) is $w = 0.26978475$. If w is very small (e.g., $w < 0.05$), the null-hypothesis is rejected. If more sequences can be tested, the probability w has to be ≥ 0.05 for about 95% of the tested bit sequences.

Test 4:

Frequencies of overlapping 2-tuples:

tuples 00:	19994940	tuples 01:	20000123
tuples 10:	20000123	tuples 11:	20004814

Check size: Chi-square of 2-bit patterns minus chi square of 1-bit patterns
Theoretical maximum chi-square = 5.99
Chi-square value = 1.22

Test 5:

Frequencies of 2-tuples on even places:

tuples 00:	9998275	tuples 01:	10000870
tuples 10:	9997643	tuples 11:	10003212

Theoretical maximum chi-square = 7.81
Chi-square value = 1.96

Test 6:

Frequencies of 2-tuples on odd places:

tuples 00:	9996665	tuples 01:	9999253
tuples 10:	10002480	tuples 11:	10001602

Theoretical maximum chi-square = 7.81
Chi-square value = 2.04

Result of statistical analysis of file p3.dat:

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The tests: 1 2 3 4 5 6 were fulfilled!

The null-hypothesis is accepted!