

Basic statistical test of bit sequences

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Date/Time: 10.01.2013,15:45 hour

file: taes1.rnd size: 10240000 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	39562	39805	39929	40247	39762	39932	39958	40163
08	39933	40226	39972	40108	40264	40252	39933	39844
10	40089	39853	40097	40138	39720	39984	40268	39750
18	39560	39862	39877	40330	39959	39946	39901	40095
20	40072	39715	39982	40037	40095	39767	40256	40056
28	39891	39799	40211	39912	39935	39970	39805	40058
30	39992	40019	40300	39831	40075	40034	40539	39974
38	39870	40144	40018	39856	39586	40090	39741	39971
40	39959	40258	39676	39846	40255	40322	40085	39896
48	39785	40100	40273	40067	39923	39835	39770	40060
50	39844	39755	40044	40042	40158	39905	40285	40063
58	40013	40004	40119	40185	39941	39987	39674	40143
60	40244	39535	40086	40115	39985	39858	40062	40104
68	39878	40334	40009	39881	39898	40117	40242	39825
70	39781	39965	40488	39817	40062	39805	40278	39922
78	40255	39715	40070	40017	40216	40300	40183	39799
80	40163	39927	40033	39997	39884	39834	40163	40215
88	39938	39821	39952	40056	40241	39843	39876	39765
90	40100	39811	40042	39677	39711	39942	40091	39999
98	40167	39683	40045	39744	40095	40270	40353	39712
a0	40218	39938	40214	40067	39579	40005	40054	40081
a8	39741	39687	40334	39871	40202	40246	40387	40239
b0	39804	40056	40438	40201	40154	40045	40331	39828
b8	39877	39935	39951	39837	39770	40152	39862	40024
c0	39752	39918	39973	39762	39829	40384	40530	40071
c8	40307	39996	39995	40238	40186	40185	39807	40065
d0	40163	40162	39785	40044	40078	39859	40115	39913
d8	39789	39813	39745	39578	39951	39969	40137	40315
e0	40049	39850	39951	39907	40189	40078	39712	39752
e8	39580	39716	40205	40079	40336	40222	39730	39902
f0	40411	39960	39882	40187	39875	39851	40069	39908
f8	40216	39964	40341	39624	40147	40059	39758	39760

Evaluation of count of 10240000 Bytes = 81920000 Bits:

Theoretical average of byte-frequencies: 40000
'61' = 39535 (minimum) '36' = 40539 (maximum)

Theoretical interval I of byte-frequencies:
I = (39609 to 40391) (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: 7 greater: 5 summary: 12

Test 2:

Evaluation of byte-frequencies
Chi-square non-overlapping:

Theoretical maximum chi-square = 293.25
Chi-square value = 255.15

Chi-square overlapping:
Theoretical maximum chi-square = 155.40
Chi-square value = 119.16

Test 3:

$r = 0.50002217$ (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 $(0.49997783, 0.50002217)$ is $w = 0.68814582$. 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: 20474974 tuples 01: 20483209
tuples 10: 20483208 tuples 11: 20478609

Check size: Chi-square of 2-bit patterns minus chi square of 1-bit patterns
Theoretical maximum chi-square = 5.99
Chi-square value = 2.17

Test 5:

Frequencies of 2-tuples on even places:
tuples 00: 10238255 tuples 01: 10239448
tuples 10: 10242224 tuples 11: 10240073

Theoretical maximum chi-square = 7.81
Chi-square value = 0.81

Test 6:

Frequencies of 2-tuples on odd places:
tuples 00: 10236719 tuples 01: 10243761
tuples 10: 10240984 tuples 11: 10238536

Theoretical maximum chi-square = 7.81
Chi-square value = 2.74

Result of statistical analysis of file taes1.rnd:

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

The null-hypothesis is accepted!