

## Basic statistical test of bit sequences

Date/Time: 04.10.2016,15:45 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  $\geq 0.05$  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:

=====

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

The null-hypothesis is accepted!

#####  
 THE NIST STATISTICAL TEST SUITE  
 #####

-----  
 1. FREQUENCY TEST  
 -----

Computational information:  
 (a) The nth partial sum = 474  
 (b)  $S_n/n$  = 0.000474  
 p\_value = 0.635500, SUCCESS

-----  
 2. BLOCK FREQUENCY TEST  
 -----

Computational information:  
 (a)  $\chi^2$  = 124960.500000  
 (b) # of substrings = 125000  
 (c) block length = 8  
 p\_value = 0.530957, SUCCESS

-----  
 3. CUMULATIVE SUMS TEST  
 -----

Cumulative sums forward test:

Computational information:  
 (a) The maximum partial sum =

p\_value = 0.807587, SUCCESS

Cumulative sums reverse test:

Computational information:  
 (a) The maximum partial sum =

p\_value = 0.849583, SUCCESS

-----  
 4. RUNS TEST  
 -----

Computational information:  
 (a)  $\pi$  = 0.500237  
 (b)  $V_{n\_obs}$  (Total # of runs) = 499582  
 (c)  $V_{n\_obs} - 2 n \pi (1-\pi)$   
       ----- = 0.590983  
        $2 \sqrt{2n} \pi (1-\pi)$

p\_value = 0.403281, SUCCESS

-----  
 5. LONGEST RUNS OF ONES TEST  
 -----

Computational information:  
 (a) N (# of substrings) = 100  
 (b) M (Substring Length) = 10000  
 (c)  $\chi^2$  = 8.991259

Frequency

<=10	11	12	13	14	15	>=16
7	17	24	24	14	2	12

p\_value = 0.174070, SUCCESS

-----  
6. RANK TEST  
-----

Computational information:

- (a) Probability  $P_{32} = 0.288788$
- (b)  $P_{31} = 0.577576$
- (c)  $P_{30} = 0.133636$
- (d) Frequency  $F_{32} = 297$
- (e)  $F_{31} = 562$
- (f)  $F_{30} = 117$
- (g) # of matrices = 976
- (h)  $\text{Chi}^2 = 2.201311$
- (i) NOTE: 576 BITS WERE DISCARDED.

p\_value = 0.332653, SUCCESS

-----  
7. DFT TEST  
-----

Computational information:

- (a) Percentile = 95.004000
- (b)  $N_l = 475020.000000$
- (c)  $N_o = 475000.000000$
- (d)  $d = 0.129777$

p\_value = 0.896743, SUCCESS

-----  
8. NONOVERLAPPING TEMPLATES TEST  
-----

Computational information:

LAMBDA = 122.061523  
M = 125000, N = 8, m = 10, n = 1000000

Template	W_1	W_2	W_3	W_4	W_5	W_6	W_7	W_8
1100100100	116	116	114	130	113	122	143	144

chi2\_value = 10.043987  
p\_value = 0.261952, SUCCESS

-----  
9. OVERLAPPING TEMPLATE OF ALL ONES TEST  
-----

Computational information:

- (a) n (sequence\_length) = 1000000
- (b) m (block length of 1s) = 10
- (c) M (length of substring) = 1032
- (d) N (number of substrings) = 968
- (e)  $\lambda [(M-m+1)/2^m] = 0.999023$
- (f)  $\eta = 0.499512$

Frequency:

0	1	2	3	4	>=5	Chi^2
573	154	92	59	34	56	1.2773

p\_value = 0.937254, SUCCESS

-----  
10. UNIVERSAL TEST  
-----

Computational information:

(a) L = 7  
(b) Q = 1280  
(c) K = 141577  
(d) sum = 876867.128880  
(e) sigma = 0.002768  
(f) variance = 3.125000  
(g) exp\_value = 6.196251  
(h) phi = 6.193570  
(i) WARNING: 1 bits were discarded.

p\_value = 0.332977, SUCCESS

-----  
11. APPROXIMATE ENTROPY TEST  
-----

Computational information:

(a) m (block length) = 5  
(b) n (sequence length) = 1000000  
(c) Chi<sup>2</sup> = 24.309741  
(d) Phi(m) = -3.465728  
(e) Phi(m+1) = -4.158863  
(f) ApEn = 0.693135  
(g) Log(2) = 0.693147

p\_value = 0.832989, SUCCESS

-----  
12. RANDOM EXCURSIONS TEST  
-----

Computational information:

(a) Number Of Cycles (J) = 2512  
(b) Sequence Length (n) = 1000000  
(c) Rejection Constraint = 500.000000

x = -4 chi<sup>2</sup> = 11.598574 p\_value = 0.040722, SUCCESS  
x = -3 chi<sup>2</sup> = 1.362697 p\_value = 0.928350, SUCCESS  
x = -2 chi<sup>2</sup> = 1.130986 p\_value = 0.951324, SUCCESS  
x = -1 chi<sup>2</sup> = 3.262739 p\_value = 0.659551, SUCCESS  
x = 1 chi<sup>2</sup> = 4.167994 p\_value = 0.525491, SUCCESS  
x = 2 chi<sup>2</sup> = 3.276244 p\_value = 0.657481, SUCCESS  
x = 3 chi<sup>2</sup> = 6.225265 p\_value = 0.284913, SUCCESS  
x = 4 chi<sup>2</sup> = 2.899353 p\_value = 0.715499, SUCCESS

-----  
13. RANDOM EXCURSIONS VARIANT TEST  
-----

Computational information:

(a) Number Of Cycles (J) = 2512  
(b) Sequence Length (n) = 1000000

(x = -9) Total visits = 2558; p-value = 0.874929  
SUCCESS  
(x = -8) Total visits = 2612; p-value = 0.715653  
SUCCESS  
(x = -7) Total visits = 2570; p-value = 0.820462  
SUCCESS  
(x = -6) Total visits = 2456; p-value = 0.811715  
SUCCESS  
(x = -5) Total visits = 2403; p-value = 0.608230  
SUCCESS  
(x = -4) Total visits = 2450; p-value = 0.740938  
SUCCESS  
(x = -3) Total visits = 2479; p-value = 0.835064  
SUCCESS  
(x = -2) Total visits = 2522; p-value = 0.935081  
SUCCESS  
(x = -1) Total visits = 2548; p-value = 0.611524  
SUCCESS

(x = 1) Total visits = 2426; p-value = 0.225009  
SUCCESS  
(x = 2) Total visits = 2381; p-value = 0.285948  
SUCCESS  
(x = 3) Total visits = 2353; p-value = 0.315765  
SUCCESS  
(x = 4) Total visits = 2333; p-value = 0.339827  
SUCCESS  
(x = 5) Total visits = 2371; p-value = 0.507272  
SUCCESS  
(x = 6) Total visits = 2391; p-value = 0.606754  
SUCCESS  
(x = 7) Total visits = 2320; p-value = 0.452481  
SUCCESS  
(x = 8) Total visits = 2216; p-value = 0.280920  
SUCCESS  
(x = 9) Total visits = 2237; p-value = 0.346712  
SUCCESS

-----  
14. SERIAL TEST  
-----

Computational information:

(a) Block length (m) = 5  
(b) Sequence length (n) = 1000000  
(c) Psi\_m = 15.867520  
(d) Psi\_m-1 = 5.523296  
(e) Psi\_m-2 = 2.093920  
(f) Del\_1 = 10.344224  
(g) Del\_2 = 6.914848

p\_value1 = 0.848045, SUCCESS

p\_value2 = 0.545847, SUCCESS

-----  
15. LEMPEL-ZIV COMPRESSION TEST  
-----

Computational information:

(a) W (# of words) = 69575

p\_value = 0.061457, SUCCESS

#####  
 Diehard Test-Suite  
 #####

BIRTHDAY SPACINGS TEST, M= 512 N=2\*\*24 LAMBDA= 2.0000  
 taes1.rnd using bits 1 to 24 p-value= .732352  
 taes1.rnd using bits 2 to 25 p-value= .441727  
 taes1.rnd using bits 3 to 26 p-value= .007405  
 taes1.rnd using bits 4 to 27 p-value= .813373  
 taes1.rnd using bits 5 to 28 p-value= .115171  
 taes1.rnd using bits 6 to 29 p-value= .393101  
 taes1.rnd using bits 7 to 30 p-value= .847603  
 taes1.rnd using bits 8 to 31 p-value= .099781  
 taes1.rnd using bits 9 to 32 p-value= .105542

The 9 p-values were  
 .732352 .441727 .007405 .813373 .115171  
 .393101 .847603 .099781 .105542

A KSTEST for the 9 p-values yields .745850

-----  
 OPERM5 test for file taes1.rnd  
 chisquare for 99 degrees of freedom= 82.328; p-value= .112956  
 OPERM5 test for file taes1.rnd  
 chisquare for 99 degrees of freedom= 87.796; p-value= .217431  
 -----

Binary rank test for taes1.rnd

Rank test for 31x31 binary matrices:  
 rows from leftmost 31 bits of each 32-bit integer  

rank	observed	expected	(o-e)^2/e	sum
28	182	211.4	4.093405	4.093
29	5195	5134.0	.724531	4.818
30	23143	23103.0	.069093	4.887
31	11480	11551.5	.442863	5.330

 chisquare= 5.330 for 3 d. of f.; p-value= .861307

Binary rank test for taes1.rnd

Rank test for 32x32 binary matrices:  
 rows from leftmost 32 bits of each 32-bit integer  

rank	observed	expected	(o-e)^2/e	sum
29	181	211.4	4.376428	4.376
30	4976	5134.0	4.863107	9.240
31	23310	23103.0	1.853850	11.093
32	11533	11551.5	.029706	11.123

 chisquare=11.123 for 3 d. of f.; p-value= .989348  
 -----

b-rank test for bits 1 to 8 p=1-exp(-SUM/2)= .59320  
 b-rank test for bits 2 to 9 p=1-exp(-SUM/2)= .47113  
 b-rank test for bits 3 to 10 p=1-exp(-SUM/2)= .72991  
 b-rank test for bits 4 to 11 p=1-exp(-SUM/2)= .88404  
 b-rank test for bits 5 to 12 p=1-exp(-SUM/2)= .33460  
 b-rank test for bits 6 to 13 p=1-exp(-SUM/2)= .80056  
 b-rank test for bits 7 to 14 p=1-exp(-SUM/2)= .20357  
 b-rank test for bits 8 to 15 p=1-exp(-SUM/2)= .37389  
 b-rank test for bits 9 to 16 p=1-exp(-SUM/2)= .09358  
 b-rank test for bits 10 to 17 p=1-exp(-SUM/2)= .58868  
 b-rank test for bits 11 to 18 p=1-exp(-SUM/2)= .81523  
 b-rank test for bits 12 to 19 p=1-exp(-SUM/2)= .06497  
 b-rank test for bits 13 to 20 p=1-exp(-SUM/2)= .96420  
 b-rank test for bits 14 to 21 p=1-exp(-SUM/2)= .89280  
 b-rank test for bits 15 to 22 p=1-exp(-SUM/2)= .66964  
 b-rank test for bits 16 to 23 p=1-exp(-SUM/2)= .10005  
 b-rank test for bits 17 to 24 p=1-exp(-SUM/2)= .14185  
 b-rank test for bits 18 to 25 p=1-exp(-SUM/2)= .09615  
 b-rank test for bits 19 to 26 p=1-exp(-SUM/2)= .28939  
 b-rank test for bits 20 to 27 p=1-exp(-SUM/2)= .24190  
 b-rank test for bits 21 to 28 p=1-exp(-SUM/2)= .52847  
 b-rank test for bits 22 to 29 p=1-exp(-SUM/2)= .05579  
 b-rank test for bits 23 to 30 p=1-exp(-SUM/2)= .07577  
 b-rank test for bits 24 to 31 p=1-exp(-SUM/2)= .29206  
 b-rank test for bits 25 to 32 p=1-exp(-SUM/2)= .11641

TEST SUMMARY, 25 tests on 100,000 random 6x8 matrices  
 These should be 25 uniform [0,1] random variables:

.593202	.471134	.729906	.884040	.334596
.800559	.203569	.373894	.093583	.588676
.815229	.064973	.964198	.892796	.669644
.100046	.141854	.096155	.289389	.241901
.528472	.055787	.075773	.292065	.116414

brank test summary for taes1.rnd

The KS test for those 25 supposed UNI's yields

KS p-value= .818483

-----

No. missing words should average 141909. with sigma=428.

tst no 1:	141638 missing words,	-.63 sigmas from mean,	p-value= .26306
tst no 2:	142090 missing words,	.42 sigmas from mean,	p-value= .66354
tst no 3:	141015 missing words,	-2.09 sigmas from mean,	p-value= .01833
tst no 4:	141842 missing words,	-.16 sigmas from mean,	p-value= .43750
tst no 5:	142419 missing words,	1.19 sigmas from mean,	p-value= .88314
tst no 6:	142015 missing words,	.25 sigmas from mean,	p-value= .59751
tst no 7:	141789 missing words,	-.28 sigmas from mean,	p-value= .38930
tst no 8:	140759 missing words,	-2.69 sigmas from mean,	p-value= .00360
tst no 9:	142490 missing words,	1.36 sigmas from mean,	p-value= .91256
tst no 10:	142206 missing words,	.69 sigmas from mean,	p-value= .75589
tst no 11:	141568 missing words,	-.80 sigmas from mean,	p-value= .21258
tst no 12:	142039 missing words,	.30 sigmas from mean,	p-value= .61904
tst no 13:	141570 missing words,	-.79 sigmas from mean,	p-value= .21394
tst no 14:	142047 missing words,	.32 sigmas from mean,	p-value= .62615
tst no 15:	141908 missing words,	.00 sigmas from mean,	p-value= .49876
tst no 16:	141764 missing words,	-.34 sigmas from mean,	p-value= .36710
tst no 17:	142882 missing words,	2.27 sigmas from mean,	p-value= .98847
tst no 18:	141855 missing words,	-.13 sigmas from mean,	p-value= .44950
tst no 19:	142074 missing words,	.38 sigmas from mean,	p-value= .64979
tst no 20:	142441 missing words,	1.24 sigmas from mean,	p-value= .89292

-----

OPSO for taes1.rnd	using bits 23 to 32	142173	.909	.8184
OPSO for taes1.rnd	using bits 22 to 31	142079	.585	.7208
OPSO for taes1.rnd	using bits 21 to 30	142030	.416	.6613
OPSO for taes1.rnd	using bits 20 to 29	141508	-1.384	.0832
OPSO for taes1.rnd	using bits 19 to 28	142202	1.009	.8436
OPSO for taes1.rnd	using bits 18 to 27	141711	-.684	.2470
OPSO for taes1.rnd	using bits 17 to 26	141839	-.243	.4042
OPSO for taes1.rnd	using bits 16 to 25	142195	.985	.8377
OPSO for taes1.rnd	using bits 15 to 24	142089	.620	.7322
OPSO for taes1.rnd	using bits 14 to 23	141953	.151	.5599
OPSO for taes1.rnd	using bits 13 to 22	141896	-.046	.4817
OPSO for taes1.rnd	using bits 12 to 21	142025	.399	.6550
OPSO for taes1.rnd	using bits 11 to 20	142556	2.230	.9871
OPSO for taes1.rnd	using bits 10 to 19	142273	1.254	.8951
OPSO for taes1.rnd	using bits 9 to 18	142148	.823	.7947
OPSO for taes1.rnd	using bits 8 to 17	141988	.271	.6069
OPSO for taes1.rnd	using bits 7 to 16	141625	-.980	.1634
OPSO for taes1.rnd	using bits 6 to 15	141991	.282	.6109
OPSO for taes1.rnd	using bits 5 to 14	141637	-.939	.1738
OPSO for taes1.rnd	using bits 4 to 13	141847	-.215	.4149
OPSO for taes1.rnd	using bits 3 to 12	141785	-.429	.3341
OPSO for taes1.rnd	using bits 2 to 11	141618	-1.005	.1575
OPSO for taes1.rnd	using bits 1 to 10	142334	1.464	.9285
OQSO for taes1.rnd	using bits 28 to 32	141964	.185	.5735
OQSO for taes1.rnd	using bits 27 to 31	141851	-.198	.4216
OQSO for taes1.rnd	using bits 26 to 30	141728	-.615	.2694
OQSO for taes1.rnd	using bits 25 to 29	142172	.890	.8134
OQSO for taes1.rnd	using bits 24 to 28	142112	.687	.7540
OQSO for taes1.rnd	using bits 23 to 27	141637	-.923	.1780
OQSO for taes1.rnd	using bits 22 to 26	141288	-2.106	.0176
OQSO for taes1.rnd	using bits 21 to 25	141950	.138	.5548
OQSO for taes1.rnd	using bits 20 to 24	141726	-.621	.2672
OQSO for taes1.rnd	using bits 19 to 23	141336	-1.943	.0260
OQSO for taes1.rnd	using bits 18 to 22	142073	.555	.7105
OQSO for taes1.rnd	using bits 17 to 21	141995	.290	.6142



QQSO for taesl.rnd	using bits 16 to 20	142113	.690	.7550
QQSO for taesl.rnd	using bits 15 to 19	142264	1.202	.8854
QQSO for taesl.rnd	using bits 14 to 18	141396	-1.740	.0409
QQSO for taesl.rnd	using bits 13 to 17	142231	1.090	.8622
QQSO for taesl.rnd	using bits 12 to 16	141595	-1.066	.1433
QQSO for taesl.rnd	using bits 11 to 15	142023	.385	.6500
QQSO for taesl.rnd	using bits 10 to 14	141869	-.137	.4456
QQSO for taesl.rnd	using bits 9 to 13	141393	-1.750	.0400
QQSO for taesl.rnd	using bits 8 to 12	141715	-.659	.2550
QQSO for taesl.rnd	using bits 7 to 11	142095	.629	.7355
QQSO for taesl.rnd	using bits 6 to 10	142183	.928	.8232
QQSO for taesl.rnd	using bits 5 to 9	142139	.779	.7819
QQSO for taesl.rnd	using bits 4 to 8	142521	2.073	.9809
QQSO for taesl.rnd	using bits 3 to 7	142058	.504	.6929
QQSO for taesl.rnd	using bits 2 to 6	142170	.884	.8116
QQSO for taesl.rnd	using bits 1 to 5	141528	-1.293	.0981
DNA for taesl.rnd	using bits 31 to 32	141696	-.629	.2646
DNA for taesl.rnd	using bits 30 to 31	142456	1.613	.9466
DNA for taesl.rnd	using bits 29 to 30	141860	-.146	.4422
DNA for taesl.rnd	using bits 28 to 29	141974	.191	.5756
DNA for taesl.rnd	using bits 27 to 28	141865	-.131	.4480
DNA for taesl.rnd	using bits 26 to 27	142322	1.217	.8883
DNA for taesl.rnd	using bits 25 to 26	141962	.155	.5617
DNA for taesl.rnd	using bits 24 to 25	142037	.377	.6468
DNA for taesl.rnd	using bits 23 to 24	142083	.512	.6958
DNA for taesl.rnd	using bits 22 to 23	141344	-1.668	.0477
DNA for taesl.rnd	using bits 21 to 22	141931	.064	.5255
DNA for taesl.rnd	using bits 20 to 21	142380	1.388	.9175
DNA for taesl.rnd	using bits 19 to 20	142453	1.604	.9456
DNA for taesl.rnd	using bits 18 to 19	141856	-.157	.4375
DNA for taesl.rnd	using bits 17 to 18	141809	-.296	.3836
DNA for taesl.rnd	using bits 16 to 17	141554	-1.048	.1473
DNA for taesl.rnd	using bits 15 to 16	141420	-1.443	.0744
DNA for taesl.rnd	using bits 14 to 15	142068	.468	.6801
DNA for taesl.rnd	using bits 13 to 14	141835	-.219	.4132
DNA for taesl.rnd	using bits 12 to 13	142075	.489	.6875
DNA for taesl.rnd	using bits 11 to 12	142291	1.126	.8699
DNA for taesl.rnd	using bits 10 to 11	141750	-.470	.3192
DNA for taesl.rnd	using bits 9 to 10	142368	1.353	.9120
DNA for taesl.rnd	using bits 8 to 9	141975	.194	.5768
DNA for taesl.rnd	using bits 7 to 8	141785	-.367	.3569
DNA for taesl.rnd	using bits 6 to 7	142324	1.223	.8894
DNA for taesl.rnd	using bits 5 to 6	142163	.748	.7729
DNA for taesl.rnd	using bits 4 to 5	142049	.412	.6598
DNA for taesl.rnd	using bits 3 to 4	141963	.158	.5629
DNA for taesl.rnd	using bits 2 to 3	142546	1.878	.9698
DNA for taesl.rnd	using bits 1 to 2	142264	1.046	.8523

-----

Test results for taesl.rnd

Chi-square with  $5^5-5^4=2500$  d.of f. for sample size:2560000

	chisquare	equiv normal	p-value
Results fo COUNT-THE-1's in successive bytes:			
byte stream for taesl.rnd	2513.53	.191	.575848
byte stream for taesl.rnd	2464.21	-.506	.306384

-----

Chi-square with  $5^5-5^4=2500$  d.of f. for sample size: 256000

	chisquare	equiv normal	p value
Results for COUNT-THE-1's in specified bytes:			
bits 1 to 8	2467.04	-.466	.320578
bits 2 to 9	2530.13	.426	.664966
bits 3 to 10	2553.18	.752	.774018
bits 4 to 11	2523.19	.328	.628536
bits 5 to 12	2570.18	.992	.839510
bits 6 to 13	2427.26	-1.029	.151800
bits 7 to 14	2577.83	1.101	.864475
bits 8 to 15	2620.05	1.698	.955225
bits 9 to 16	2539.34	.556	.711024
bits 10 to 17	2396.09	-1.470	.070841

bits 11 to 18	2455.37	-.631	.263964
bits 12 to 19	2362.88	-1.939	.026245
bits 13 to 20	2504.03	.057	.522705
bits 14 to 21	2390.50	-1.549	.060744
bits 15 to 22	2490.66	-.132	.447471
bits 16 to 23	2520.55	.291	.614344
bits 17 to 24	2544.72	.632	.736450
bits 18 to 25	2453.22	-.662	.254126
bits 19 to 26	2548.36	.684	.753005
bits 20 to 27	2488.50	-.163	.435389
bits 21 to 28	2377.67	-1.730	.041808
bits 22 to 29	2443.96	-.792	.214044
bits 23 to 30	2566.17	.936	.825321
bits 24 to 31	2664.64	2.328	.990055
bits 25 to 32	2661.52	2.284	.988823

-----

CDPARK: result of ten tests on file taes1.rnd  
 Of 12,000 tries, the average no. of successes  
 should be 3523 with sigma=21.9

Successes: 3479	z-score: -2.009	p-value: .022262
Successes: 3522	z-score: -.046	p-value: .481790
Successes: 3543	z-score: .913	p-value: .819442
Successes: 3536	z-score: .594	p-value: .723613
Successes: 3514	z-score: -.411	p-value: .340551
Successes: 3500	z-score: -1.050	p-value: .146807
Successes: 3552	z-score: 1.324	p-value: .907282
Successes: 3515	z-score: -.365	p-value: .357445
Successes: 3548	z-score: 1.142	p-value: .873180
Successes: 3561	z-score: 1.735	p-value: .958644

square size	avg. no. parked	sample sigma
100.	3527.000	24.343

KSTEST for the above 10: p= .343710

-----

This is the MINIMUM DISTANCE test  
 for random integers in the file taes1.rnd

Sample no.	d^2	avg	equiv uni
5	.1721	.6354	.158840
10	2.8389	1.1258	.942341
15	.0721	1.1329	.069883
20	1.0535	.9666	.653126
25	1.3439	.9925	.740918
30	.3471	.9033	.294494
35	.4523	.8802	.365267
40	1.6034	.8820	.800404
45	1.1710	.8738	.691764
50	.7622	.8550	.535159
55	2.0705	.8654	.875185
60	2.5056	.8581	.919399
65	1.9319	.8579	.856534
70	1.7826	.8595	.833303
75	.6230	.8634	.465330
80	.5124	.8626	.402460
85	.6409	.8471	.474884
90	.5578	.8219	.429149
95	.0179	.8518	.017849
100	.3911	.8592	.325007

MINIMUM DISTANCE TEST for taes1.rnd

Result of KS test on 20 transformed mindist^2's:  
 p-value= .524249

-----

The 3DSPHERES test for file taes1.rnd

sample no: 1	r^3= 52.831	p-value= .82813
sample no: 2	r^3= 12.849	p-value= .34838
sample no: 3	r^3= 3.516	p-value= .11058
sample no: 4	r^3= 43.259	p-value= .76354
sample no: 5	r^3= 19.434	p-value= .47681
sample no: 6	r^3= 13.230	p-value= .35660

```

sample no: 7      r^3= 39.815      p-value= .73477
sample no: 8      r^3= 47.744      p-value= .79637
sample no: 9      r^3= 11.126      p-value= .30985
sample no: 10     r^3= 60.781      p-value= .86814
sample no: 11     r^3= .069        p-value= .00229
sample no: 12     r^3= 6.201        p-value= .18673
sample no: 13     r^3= 26.505      p-value= .58666
sample no: 14     r^3= 5.578        p-value= .16968
sample no: 15     r^3= 44.841      p-value= .77569
sample no: 16     r^3= 20.799      p-value= .50008
sample no: 17     r^3= 40.731      p-value= .74274
sample no: 18     r^3= 31.489      p-value= .64994
sample no: 19     r^3= 39.710      p-value= .73384
sample no: 20     r^3= 41.537      p-value= .74957

```

3DSPHERES test for file taes1.rnd p-value= .571827

-----  
RESULTS OF SQUEEZE TEST FOR taes1.rnd  
Table of standardized frequency counts  
( (obs-exp)/sqrt(exp) )^2

for j taking values <=6,7,8,...,47,>=48:

-.8	1.3	-.6	.5	-.8	.6
.0	-1.6	.7	-2.9	1.1	.2
-1.2	.9	-.1	-.5	1.9	.3
-.6	-.9	-.1	-1.1	-.7	.8
-.6	1.3	.9	1.2	1.0	.6
.0	1.0	.2	.8	-.2	-.1
1.0	-.7	.1	.4	.9	1.0
-1.1					

Chi-square with 42 degrees of freedom: 38.757  
z-score= -.354 p-value= .385665

-----  
Test no. 1 p-value .407500  
Test no. 2 p-value .896252  
Test no. 3 p-value .243365  
Test no. 4 p-value .181625  
Test no. 5 p-value .430341  
Test no. 6 p-value .585691  
Test no. 7 p-value .963620  
Test no. 8 p-value .351454  
Test no. 9 p-value .484607  
Test no. 10 p-value .560133

Results of the OSUM test for taes1.rnd  
KSTEST on the above 10 p-values: .294647

-----  
The RUNS test for file taes1.rnd  
Up and down runs in a sample of 10000

-----  
Run test for taes1.rnd :  
runs up; ks test for 10 p's: .515991  
runs down; ks test for 10 p's: .530047  
Run test for taes1.rnd :  
runs up; ks test for 10 p's: .919836  
runs down; ks test for 10 p's: .104965

-----  
Results of craps test for taes1.rnd  
No. of wins: Observed Expected  
                  98223 98585.86  
Chisq= 29.25 for 20 degrees of freedom, p= .91705  
Throws Observed Expected Chisq Sum  
SUMMARY FOR taes1.rnd  
p-value for no. of wins: .052303  
p-value for throws/game: .917048  
Test completed. File taes1.rnd

::