

Basic statistical test of bit sequences

Date/Time: 2.07.2017,17:07 hour

file: PRG420_m20.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	40104	40256	39861	40003	40016	39948	39947	39811
08	39889	39923	40105	39993	40258	40156	39828	40115
10	39715	39957	40026	40200	39940	40202	40400	40328
18	39990	39980	40223	40216	39753	40070	40060	39903
20	40089	39986	39650	39978	40087	40253	40223	39795
28	40293	39976	40075	40357	40250	39781	40070	40134
30	40054	39987	40195	40182	39586	39800	39857	40098
38	39862	40405	40205	39922	40189	40079	39972	40113
40	40184	40132	40300	39756	39859	39799	40137	39837
48	39639	39906	39716	39809	40254	40414	39850	40343
50	39848	40094	39857	40125	39491	39853	40224	39476
58	39980	40073	39964	40029	40047	40010	39813	40038
60	40250	39722	39981	39605	39898	39790	40353	40064
68	40068	40168	39993	40179	39580	39804	40047	40024
70	39683	39987	40136	40263	39770	40018	40353	39971
78	40214	40233	40149	40124	40216	39968	40166	39782
80	39948	40079	39731	39918	40159	40006	39947	39958
88	40166	40092	40193	39540	40206	40094	40222	39989
90	39584	40104	39832	39703	40155	40013	39912	40300
98	40076	39644	39909	40596	39912	39750	40083	39867
a0	39868	40177	40139	40054	39955	39818	40382	39680
a8	40061	40135	39860	39600	39788	39483	39974	40239
b0	39970	39940	39495	40078	39960	40019	39699	40164
b8	40258	40215	40032	40081	40206	39958	40008	39529
c0	40245	40121	40070	39624	39724	39999	40064	39567
c8	40001	40353	39953	39925	40214	39779	39823	39867
d0	40600	39950	39722	39925	39818	40090	40096	40038
d8	40474	39778	40055	40266	40049	39913	39960	39862
e0	39856	40254	39931	39819	40288	40487	40313	39799
e8	39972	40035	39758	39983	39849	40217	39761	39775
f0	39913	39650	40389	39677	39781	39901	40006	40144
f8	39892	39978	39853	39915	39990	40084	40088	40109

Evaluation of count of 10240000 Bytes = 81920000 Bits:

Theoretical average of byte-frequencies: 40000
 '57' = 39476 (minimum) 'd0' = 40600 (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: 12 greater: 7 summary: 19

Test 2:

Evaluation of byte-frequencies

Chi-square non-overlapping:
Theoretical maximum chi-square = 293.25
Chi-square value = 285.40

Chi-square overlapping:
Theoretical maximum chi-square = 155.40
Chi-square value = 152.96

Test 3:

$r = 0.49996194$ (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 $(0.49996194, 0.50003803)$ is $w = 0.49121585$. 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: 20484807 tuples 01: 20478312
tuples 10: 20478311 tuples 11: 20478570

Check size: Chi-square of 2-bit patterns minus chi square of 1-bit patterns
Theoretical maximum chi-square = 5.99
Chi-square value = 1.03

Test 5:

Frequencies of 2-tuples on even places:
tuples 00: 10240930 tuples 01: 10239609
tuples 10: 10241649 tuples 11: 10237812

Theoretical maximum chi-square = 7.81
Chi-square value = 0.83

Test 6:

Frequencies of 2-tuples on odd places:
tuples 00: 10243877 tuples 01: 10238703
tuples 10: 10236662 tuples 11: 10240758

Theoretical maximum chi-square = 7.81
Chi-square value = 2.78

Result of statistical analysis of file PRG420_m20.rnd:

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

The null-hypothesis is accepted!

 THE NIST STATISTICAL TEST SUITE
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 1. FREQUENCY TEST

Computational information:
 (a) The nth partial sum = 736
 (b) S_n/n = 0.000736
 p_value = 0.461731, SUCCESS

 2. BLOCK FREQUENCY TEST

Computational information:
 (a) χ^2 = 125031.000000
 (b) # of substrings = 125000
 (c) block length = 8
 p_value = 0.474753, SUCCESS

 3. CUMULATIVE SUMS TEST

Cumulative sums forward test:
 Computational information:
 (a) The maximum partial sum =
 p_value = 0.357141, SUCCESS

Cumulative sums reverse test:
 Computational information:
 (a) The maximum partial sum =
 p_value = 0.710170, SUCCESS

 4. RUNS TEST

Computational information:
 (a) π = 0.500368
 (b) V_n _obs (Total # of runs) = 499550
 (c) V_n _obs - 2 n π (1- π)
 ----- = 0.636013
 2 sqrt(2n) π (1- π)
 p_value = 0.368408, SUCCESS

 5. LONGEST RUNS OF ONES TEST

Computational information:
 (a) N (# of substrings) = 100
 (b) M (Substring Length) = 10000
 (c) χ^2 = 5.449117

Frequency

<=10	11	12	13	14	15	>=16
9	28	24	12	12	8	7

p_value = 0.487628, SUCCESS

6. RANK TEST

Computational information:

(a) Probability $P_{32} = 0.288788$
(b) $P_{31} = 0.577576$
(c) $P_{30} = 0.133636$
(d) Frequency $F_{32} = 281$
(e) $F_{31} = 566$
(f) $F_{30} = 129$
(g) # of matrices = 976
(h) $\text{Chi}^2 = 0.027519$
(i) NOTE: 576 BITS WERE DISCARDED.

p_value = 0.986335, SUCCESS

7. DFT TEST

Computational information:

(a) Percentile = 94.992800
(b) $N_l = 474964.000000$
(c) $N_o = 475000.000000$
(d) $d = -0.233599$

p_value = 0.815296, 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	128	122	118	121	98	120	120	107

chi2_value = 7.238394
p_value = 0.511144, 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) η = 0.499512

Frequency:

0	1	2	3	4	>=5	Chi^2
578	162	102	48	35	43	5.5209

p_value = 0.355662, SUCCESS

10. UNIVERSAL TEST

Computational information:

(a) $L = 7$
(b) $Q = 1280$
(c) $K = 141577$
(d) $\text{sum} = 876601.540904$

(e) sigma = 0.002768
(f) variance = 3.125000
(g) exp_value = 6.196251
(h) phi = 6.191695
(i) WARNING: 1 bits were discarded.

p_value = 0.099816, SUCCESS

11. APPROXIMATE ENTROPY TEST

Computational information:

(a) m (block length) = 5
(b) n (sequence length) = 1000000
(c) Chi^2 = 27.964781
(d) Phi(m) = -3.465721
(e) Phi(m+1) = -4.158854
(f) ApEn = 0.693133
(g) Log(2) = 0.693147

p_value = 0.671101, SUCCESS

12. RANDOM EXCURSIONS TEST

Computational information:

(a) Number Of Cycles (J) = 0702
(b) Sequence Length (n) = 1000000
(c) Rejection Constraint = 500.000000

x = -4 chi^2 = 2.214251 p_value = 0.818775, SUCCESS
x = -3 chi^2 = 2.533689 p_value = 0.771413, SUCCESS
x = -2 chi^2 = 5.745770 p_value = 0.331748, SUCCESS
x = -1 chi^2 = 18.612536 p_value = 0.002269, FAILURE
x = 1 chi^2 = 5.646724 p_value = 0.342125, SUCCESS
x = 2 chi^2 = 3.824487 p_value = 0.574952, SUCCESS
x = 3 chi^2 = 2.784697 p_value = 0.733137, SUCCESS
x = 4 chi^2 = 6.170076 p_value = 0.290020, SUCCESS

13. RANDOM EXCURSIONS VARIANT TEST

Computational information:

(a) Number Of Cycles (J) = 702
(b) Sequence Length (n) = 1000000

(x = -9) Total visits = 779; p-value = 0.618198
SUCCESS
(x = -8) Total visits = 772; p-value = 0.629552
SUCCESS
(x = -7) Total visits = 765; p-value = 0.640985
SUCCESS
(x = -6) Total visits = 753; p-value = 0.681524
SUCCESS
(x = -5) Total visits = 738; p-value = 0.748774
SUCCESS
(x = -4) Total visits = 763; p-value = 0.538347
SUCCESS
(x = -3) Total visits = 798; p-value = 0.251885
SUCCESS
(x = -2) Total visits = 808; p-value = 0.102409
SUCCESS
(x = -1) Total visits = 774; p-value = 0.054664
SUCCESS
(x = 1) Total visits = 659; p-value = 0.251140
SUCCESS
(x = 2) Total visits = 664; p-value = 0.558200
SUCCESS

(x = 3) Total visits = 660; p-value = 0.616174
SUCCESS
(x = 4) Total visits = 678; p-value = 0.808710
SUCCESS
(x = 5) Total visits = 684; p-value = 0.872780
SUCCESS
(x = 6) Total visits = 670; p-value = 0.796796
SUCCESS
(x = 7) Total visits = 680; p-value = 0.870643
SUCCESS
(x = 8) Total visits = 668; p-value = 0.814762
SUCCESS
(x = 9) Total visits = 716; p-value = 0.927795
SUCCESS

14. SERIAL TEST

Computational information:

(a) Block length (m) = 5
(b) Sequence length (n) = 1000000
(c) Psi_m = 29.474368
(d) Psi_m-1 = 14.915936
(e) Psi_m-2 = 6.428096
(f) Del_1 = 14.558432
(g) Del_2 = 6.070592

p_value1 = 0.557185, SUCCESS

p_value2 = 0.639325, SUCCESS

15. LEMPEL-ZIV COMPRESSION TEST

Computational information:

(a) W (# of words) = 69582

p_value = 0.234318, SUCCESS

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#####
Diehard Test-Suite
#####
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```
BIRTHDAY SPACINGS TEST, M= 512 N=2**24 LAMBDA= 2.0000
PRG420_m20.rnd using bits 1 to 24 p-value= .540023
PRG420_m20.rnd using bits 2 to 25 p-value= .198790
PRG420_m20.rnd using bits 3 to 26 p-value= .166013
PRG420_m20.rnd using bits 4 to 27 p-value= .968593
PRG420_m20.rnd using bits 5 to 28 p-value= .775130
PRG420_m20.rnd using bits 6 to 29 p-value= .483663
PRG420_m20.rnd using bits 7 to 30 p-value= .279568
PRG420_m20.rnd using bits 8 to 31 p-value= .222318
PRG420_m20.rnd using bits 9 to 32 p-value= .446017
```

```
The 9 p-values were
.540023 .198790 .166013 .968593 .775130
.483663 .279568 .222318 .446017
```

```
A KSTEST for the 9 p-values yields .282628
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-----
OPERM5 test for file PRG420_m20.rnd
chisquare for 99 degrees of freedom= 76.348; p-value= .044223
OPERM5 test for file PRG420_m20.rnd
chisquare for 99 degrees of freedom=150.381; p-value= .999321
-----
```

```
Binary rank test for PRG420_m20.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
28 198 211.4 .851598 .852
29 5259 5134.0 3.042931 3.895
30 23027 23103.0 .250319 4.145
31 11516 11551.5 .109248 4.254
```

```
chisquare= 4.254 for 3 d. of f.; p-value= .784277
```

```
Binary rank test for PRG420_m20.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
29 196 211.4 1.124385 1.124
30 5013 5134.0 2.852250 3.977
31 23181 23103.0 .263025 4.240
32 11610 11551.5 .296012 4.536
```

```
chisquare= 4.536 for 3 d. of f.; p-value= .807468
```

```
-----
b-rank test for bits 1 to 8 p=1-exp(-SUM/2)= .35029
b-rank test for bits 2 to 9 p=1-exp(-SUM/2)= .50736
b-rank test for bits 3 to 10 p=1-exp(-SUM/2)= .00133
b-rank test for bits 4 to 11 p=1-exp(-SUM/2)= .38427
b-rank test for bits 5 to 12 p=1-exp(-SUM/2)= .69889
b-rank test for bits 6 to 13 p=1-exp(-SUM/2)= .33944
b-rank test for bits 7 to 14 p=1-exp(-SUM/2)= .40148
b-rank test for bits 8 to 15 p=1-exp(-SUM/2)= .79561
b-rank test for bits 9 to 16 p=1-exp(-SUM/2)= .47255
b-rank test for bits 10 to 17 p=1-exp(-SUM/2)= .46679
b-rank test for bits 11 to 18 p=1-exp(-SUM/2)= .02520
b-rank test for bits 12 to 19 p=1-exp(-SUM/2)= .67346
b-rank test for bits 13 to 20 p=1-exp(-SUM/2)= .61567
b-rank test for bits 14 to 21 p=1-exp(-SUM/2)= .21651
b-rank test for bits 15 to 22 p=1-exp(-SUM/2)= .43944
b-rank test for bits 16 to 23 p=1-exp(-SUM/2)= .40771
b-rank test for bits 17 to 24 p=1-exp(-SUM/2)= .08375
b-rank test for bits 18 to 25 p=1-exp(-SUM/2)= .58713
b-rank test for bits 19 to 26 p=1-exp(-SUM/2)= .68601
b-rank test for bits 20 to 27 p=1-exp(-SUM/2)= .67624
b-rank test for bits 21 to 28 p=1-exp(-SUM/2)= .10063
b-rank test for bits 22 to 29 p=1-exp(-SUM/2)= .29702
b-rank test for bits 23 to 30 p=1-exp(-SUM/2)= .89337
b-rank test for bits 24 to 31 p=1-exp(-SUM/2)= .78119
b-rank test for bits 25 to 32 p=1-exp(-SUM/2)= .92138
```

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

.350289	.507358	.001333	.384266	.698895
.339442	.401483	.795610	.472553	.466788
.025203	.673463	.615667	.216510	.439444
.407710	.083746	.587134	.686007	.676243
.100632	.297017	.893368	.781192	.921377

brank test summary for PRG420_m20.rnd

The KS test for those 25 supposed UNI's yields

KS p-value= .412508

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

tst no 1:	141260 missing words,	-1.52 sigmas from mean,	p-value= .06462
tst no 2:	141379 missing words,	-1.24 sigmas from mean,	p-value= .10766
tst no 3:	140919 missing words,	-2.31 sigmas from mean,	p-value= .01034
tst no 4:	142592 missing words,	1.60 sigmas from mean,	p-value= .94465
tst no 5:	141297 missing words,	-1.43 sigmas from mean,	p-value= .07626
tst no 6:	141966 missing words,	.13 sigmas from mean,	p-value= .55267
tst no 7:	141582 missing words,	-.76 sigmas from mean,	p-value= .22220
tst no 8:	142164 missing words,	.60 sigmas from mean,	p-value= .72409
tst no 9:	141441 missing words,	-1.09 sigmas from mean,	p-value= .13693
tst no 10:	141666 missing words,	-.57 sigmas from mean,	p-value= .28484
tst no 11:	142443 missing words,	1.25 sigmas from mean,	p-value= .89378
tst no 12:	142468 missing words,	1.31 sigmas from mean,	p-value= .90411
tst no 13:	141639 missing words,	-.63 sigmas from mean,	p-value= .26382
tst no 14:	141888 missing words,	-.05 sigmas from mean,	p-value= .48013
tst no 15:	141666 missing words,	-.57 sigmas from mean,	p-value= .28484
tst no 16:	141878 missing words,	-.07 sigmas from mean,	p-value= .47082
tst no 17:	142050 missing words,	.33 sigmas from mean,	p-value= .62880
tst no 18:	142106 missing words,	.46 sigmas from mean,	p-value= .67707
tst no 19:	141751 missing words,	-.37 sigmas from mean,	p-value= .35572
tst no 20:	142203 missing words,	.69 sigmas from mean,	p-value= .75369

OPSO for PRG420_m20.rnd	using bits 23 to 32	141801	-.374	.3544
OPSO for PRG420_m20.rnd	using bits 22 to 31	142356	1.540	.9383
OPSO for PRG420_m20.rnd	using bits 21 to 30	141720	-.653	.2569
OPSO for PRG420_m20.rnd	using bits 20 to 29	141701	-.718	.2363
OPSO for PRG420_m20.rnd	using bits 19 to 28	142086	.609	.7288
OPSO for PRG420_m20.rnd	using bits 18 to 27	141765	-.498	.3094
OPSO for PRG420_m20.rnd	using bits 17 to 26	142302	1.354	.9121
OPSO for PRG420_m20.rnd	using bits 16 to 25	141867	-.146	.4420
OPSO for PRG420_m20.rnd	using bits 15 to 24	141830	-.274	.3922
OPSO for PRG420_m20.rnd	using bits 14 to 23	141974	.223	.5882
OPSO for PRG420_m20.rnd	using bits 13 to 22	141634	-.949	.1712
OPSO for PRG420_m20.rnd	using bits 12 to 21	141830	-.274	.3922
OPSO for PRG420_m20.rnd	using bits 11 to 20	141853	-.194	.4230
OPSO for PRG420_m20.rnd	using bits 10 to 19	141928	.064	.5257
OPSO for PRG420_m20.rnd	using bits 9 to 18	142128	.754	.7746
OPSO for PRG420_m20.rnd	using bits 8 to 17	142187	.957	.8308
OPSO for PRG420_m20.rnd	using bits 7 to 16	141791	-.408	.3416
OPSO for PRG420_m20.rnd	using bits 6 to 15	142003	.323	.6267
OPSO for PRG420_m20.rnd	using bits 5 to 14	141900	-.032	.4872
OPSO for PRG420_m20.rnd	using bits 4 to 13	141820	-.308	.3790
OPSO for PRG420_m20.rnd	using bits 3 to 12	141383	-1.815	.0348
OPSO for PRG420_m20.rnd	using bits 2 to 11	141906	-.011	.4954
OPSO for PRG420_m20.rnd	using bits 1 to 10	141603	-1.056	.1454
OQSO for PRG420_m20.rnd	using bits 28 to 32	141883	-.089	.4644
OQSO for PRG420_m20.rnd	using bits 27 to 31	142151	.819	.7937
OQSO for PRG420_m20.rnd	using bits 26 to 30	141830	-.269	.3940
OQSO for PRG420_m20.rnd	using bits 25 to 29	141760	-.506	.3064
OQSO for PRG420_m20.rnd	using bits 24 to 28	141979	.236	.5934
OQSO for PRG420_m20.rnd	using bits 23 to 27	142113	.690	.7550
OQSO for PRG420_m20.rnd	using bits 22 to 26	141515	-1.337	.0907
OQSO for PRG420_m20.rnd	using bits 21 to 25	141992	.280	.6104
OQSO for PRG420_m20.rnd	using bits 20 to 24	142302	1.331	.9084
OQSO for PRG420_m20.rnd	using bits 19 to 23	141743	-.564	.2864
OQSO for PRG420_m20.rnd	using bits 18 to 22	141731	-.605	.2728
OQSO for PRG420_m20.rnd	using bits 17 to 21	141581	-1.113	.1329

OQSO for PRG420_m20.rnd	using bits 16 to 20	141711	-.672	.2507
OQSO for PRG420_m20.rnd	using bits 15 to 19	141967	.195	.5775
OQSO for PRG420_m20.rnd	using bits 14 to 18	142312	1.365	.9139
OQSO for PRG420_m20.rnd	using bits 13 to 17	141057	-2.889	.0019
OQSO for PRG420_m20.rnd	using bits 12 to 16	141857	-.177	.4296
OQSO for PRG420_m20.rnd	using bits 11 to 15	141983	.250	.5986
OQSO for PRG420_m20.rnd	using bits 10 to 14	141910	.002	.5009
OQSO for PRG420_m20.rnd	using bits 9 to 13	141796	-.384	.3504
OQSO for PRG420_m20.rnd	using bits 8 to 12	142194	.965	.8327
OQSO for PRG420_m20.rnd	using bits 7 to 11	141544	-1.238	.1078
OQSO for PRG420_m20.rnd	using bits 6 to 10	141605	-1.032	.1511
OQSO for PRG420_m20.rnd	using bits 5 to 9	141962	.179	.5709
OQSO for PRG420_m20.rnd	using bits 4 to 8	141721	-.638	.2616
OQSO for PRG420_m20.rnd	using bits 3 to 7	141879	-.103	.4591
OQSO for PRG420_m20.rnd	using bits 2 to 6	141753	-.530	.2981
OQSO for PRG420_m20.rnd	using bits 1 to 5	141657	-.855	.1962
DNA for PRG420_m20.rnd	using bits 31 to 32	142054	.427	.6652
DNA for PRG420_m20.rnd	using bits 30 to 31	141585	-.957	.1694
DNA for PRG420_m20.rnd	using bits 29 to 30	142060	.444	.6716
DNA for PRG420_m20.rnd	using bits 28 to 29	141695	-.632	.2636
DNA for PRG420_m20.rnd	using bits 27 to 28	142961	3.102	.9990
DNA for PRG420_m20.rnd	using bits 26 to 27	142020	.326	.6280
DNA for PRG420_m20.rnd	using bits 25 to 26	142276	1.082	.8603
DNA for PRG420_m20.rnd	using bits 24 to 25	141253	-1.936	.0264
DNA for PRG420_m20.rnd	using bits 23 to 24	142661	2.217	.9867
DNA for PRG420_m20.rnd	using bits 22 to 23	142363	1.338	.9096
DNA for PRG420_m20.rnd	using bits 21 to 22	142328	1.235	.8916
DNA for PRG420_m20.rnd	using bits 20 to 21	141868	-.122	.4515
DNA for PRG420_m20.rnd	using bits 19 to 20	141827	-.243	.4041
DNA for PRG420_m20.rnd	using bits 18 to 19	142546	1.878	.9698
DNA for PRG420_m20.rnd	using bits 17 to 18	142031	.359	.6402
DNA for PRG420_m20.rnd	using bits 16 to 17	142131	.654	.7434
DNA for PRG420_m20.rnd	using bits 15 to 16	141655	-.750	.2266
DNA for PRG420_m20.rnd	using bits 14 to 15	142146	.698	.7575
DNA for PRG420_m20.rnd	using bits 13 to 14	141604	-.901	.1839
DNA for PRG420_m20.rnd	using bits 12 to 13	141679	-.679	.2484
DNA for PRG420_m20.rnd	using bits 11 to 12	142308	1.176	.8802
DNA for PRG420_m20.rnd	using bits 10 to 11	141969	.176	.5699
DNA for PRG420_m20.rnd	using bits 9 to 10	141996	.256	.6009
DNA for PRG420_m20.rnd	using bits 8 to 9	141842	-.199	.4213
DNA for PRG420_m20.rnd	using bits 7 to 8	141781	-.379	.3525
DNA for PRG420_m20.rnd	using bits 6 to 7	142329	1.238	.8921
DNA for PRG420_m20.rnd	using bits 5 to 6	141614	-.871	.1918
DNA for PRG420_m20.rnd	using bits 4 to 5	141566	-1.013	.1556
DNA for PRG420_m20.rnd	using bits 3 to 4	141999	.265	.6043
DNA for PRG420_m20.rnd	using bits 2 to 3	142830	2.716	.9967
DNA for PRG420_m20.rnd	using bits 1 to 2	142034	.368	.6435

Test results for PRG420_m20.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 PRG420_m20.rnd 2539.75 .562 .713014
byte stream for PRG420_m20.rnd 2431.19 -.973 .165242

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 2609.72 1.552 .939623
bits 2 to 9 2654.89 2.190 .985754
bits 3 to 10 2470.56 -.416 .338599
bits 4 to 11 2432.23 -.958 .168920
bits 5 to 12 2501.34 .019 .507563
bits 6 to 13 2417.18 -1.171 .120743
bits 7 to 14 2538.00 .537 .704513
bits 8 to 15 2551.91 .734 .768548
bits 9 to 16 2544.78 .633 .736727
bits 10 to 17 2519.92 .282 .610931

bits 11 to 18	2436.94	-.892	.186241
bits 12 to 19	2502.87	.041	.516171
bits 13 to 20	2439.55	-.855	.196297
bits 14 to 21	2594.14	1.331	.908471
bits 15 to 22	2488.28	-.166	.434167
bits 16 to 23	2444.01	-.792	.214232
bits 17 to 24	2505.80	.082	.532682
bits 18 to 25	2457.33	-.603	.273088
bits 19 to 26	2533.47	.473	.681992
bits 20 to 27	2482.44	-.248	.401939
bits 21 to 28	2584.48	1.195	.883902
bits 22 to 29	2519.30	.273	.607567
bits 23 to 30	2557.10	.807	.790311
bits 24 to 31	2484.70	-.216	.414332
bits 25 to 32	2492.65	-.104	.458593

 CDPARK: result of ten tests on file PRG420_m20.rnd
 Of 12,000 tries, the average no. of successes
 should be 3523 with sigma=21.9

Successes: 3535	z-score: .548	p-value: .708135
Successes: 3546	z-score: 1.050	p-value: .853193
Successes: 3496	z-score: -1.233	p-value: .108811
Successes: 3517	z-score: -.274	p-value: .392053
Successes: 3488	z-score: -1.598	p-value: .055002
Successes: 3489	z-score: -1.553	p-value: .060270
Successes: 3471	z-score: -2.374	p-value: .008788
Successes: 3516	z-score: -.320	p-value: .374623
Successes: 3510	z-score: -.594	p-value: .276387
Successes: 3490	z-score: -1.507	p-value: .065925

square size	avg. no. parked	sample sigma
100.	3505.800	22.054

KSTEST for the above 10: p= .984340

 This is the MINIMUM DISTANCE test
 for random integers in the file PRG420_m20.rnd

Sample no.	d^2	avg	equiv uni
5	.3540	.9734	.299379
10	.8372	1.0787	.568879
15	4.3428	1.2458	.987281
20	.6541	1.1282	.481822
25	.5451	.9677	.421818
30	.1816	1.1934	.166844
35	2.0987	1.1289	.878674
40	1.3207	1.0921	.734814
45	.6601	1.0424	.484927
50	.4034	1.0586	.333277
55	.0881	.9783	.084763
60	.6227	.9780	.465188
65	.3980	.9738	.329659
70	1.9411	.9983	.857846
75	.4954	1.0415	.392195
80	.5913	1.0233	.448026
85	1.8839	1.0002	.849429
90	.1156	1.0110	.109714
95	.6735	1.0148	.491788
100	.0284	1.0227	.028132

MINIMUM DISTANCE TEST for PRG420_m20.rnd

Result of KS test on 20 transformed mindist^2's:
 p-value= .058693

 The 3DSPHERES test for file PRG420_m20.rnd

sample no: 1	r^3= 25.061	p-value= .56628
sample no: 2	r^3= 14.329	p-value= .37975
sample no: 3	r^3= 14.923	p-value= .39192
sample no: 4	r^3= 77.814	p-value= .92526
sample no: 5	r^3= 10.112	p-value= .28614
sample no: 6	r^3= 19.519	p-value= .47828

sample no: 7 r^3= 11.975 p-value= .32912
 sample no: 8 r^3= 49.761 p-value= .80961
 sample no: 9 r^3= 16.835 p-value= .42946
 sample no: 10 r^3= 17.748 p-value= .44656
 sample no: 11 r^3= 8.899 p-value= .25670
 sample no: 12 r^3= 16.486 p-value= .42277
 sample no: 13 r^3= 1.325 p-value= .04320
 sample no: 14 r^3= 65.516 p-value= .88739
 sample no: 15 r^3= 1.719 p-value= .05568
 sample no: 16 r^3= 4.065 p-value= .12672
 sample no: 17 r^3= 11.291 p-value= .31366
 sample no: 18 r^3= 46.885 p-value= .79046
 sample no: 19 r^3= 4.437 p-value= .13749
 sample no: 20 r^3= 8.367 p-value= .24338

3DSPHERES test for file PRG420_m20.rnd p-value= .751339

RESULTS OF SQUEEZE TEST FOR PRG420_m20.rnd
 Table of standardized frequency counts
 ((obs-exp)/sqrt(exp))^2
 for j taking values <=6,7,8,...,47,>=48:

-1.1	1.3	-.6	-1.1	-.5	.1
-.5	.5	-.3	-.4	-.5	.1
.3	.2	-1.0	.2	.8	.7
-1.1	.7	-1.0	.4	-.6	-.3
.8	1.3	-.2	.4	1.1	-.8
-.6	.4	-.1	-.5	-.4	-.3
-.2	-1.0	-1.2	1.5	-.6	.0
-.1					

Chi-square with 42 degrees of freedom: 20.757
 z-score= -2.318 p-value= .002511

Test no. 1	p-value	.832718
Test no. 2	p-value	.830992
Test no. 3	p-value	.881223
Test no. 4	p-value	.592399
Test no. 5	p-value	.950726
Test no. 6	p-value	.272827
Test no. 7	p-value	.081050
Test no. 8	p-value	.824073
Test no. 9	p-value	.312377
Test no. 10	p-value	.054758

Results of the OSUM test for PRG420_m20.rnd
 KSTEST on the above 10 p-values: .562861

The RUNS test for file PRG420_m20.rnd
Up and down runs in a sample of 10000

Run test for PRG420_m20.rnd :
 runs up; ks test for 10 p's: .696764
 runs down; ks test for 10 p's: .010102
 Run test for PRG420_m20.rnd :
 runs up; ks test for 10 p's: .811981
 runs down; ks test for 10 p's: .168418

Results of craps test for PRG420_m20.rnd
 No. of wins: Observed Expected
 98904 98585.86
 Chisq= 33.08 for 20 degrees of freedom, p= .96693
 Throws Observed Expected Chisq Sum
 SUMMARY FOR PRG420_m20.rnd
 p-value for no. of wins: .922619
 p-value for throws/game: .966929
 Test completed. File PRG420_m20.rnd

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