

TABLES OF PERCENTILE POINTS OF NONCENTRAL
CHI-SQUARE DISTRIBUTIONS

by

N. L. Johnson

University of North Carolina

Institute of Statistics Mimeo Series No. 568

February 1968

This research was supported by the Mathematics Division of the Air Force Office of Scientific Research Contract No. AF-AFOSR-68-1415, and by National Institute of General Medical Sciences under grant 5R01GM-12868.

DEPARTMENT OF STATISTICS
UNIVERSITY OF NORTH CAROLINA
Chapel Hill, N. C.

1. Introduction: The noncentral chi-square distribution is the distribution of

$$(1) \quad \sum_{j=1}^v (u_j + a_j)^2$$

where u_1, u_2, \dots, u_v are independent unit normal variables and a_1, a_2, \dots, a_v are constants. The distribution depends on v - called the degree of freedom of the distribution - and $\lambda = \sum_{j=1}^v a_j^2$ - called the noncentrality parameter of the distribution. If $\lambda = 0$ we have a (central) χ^2 distribution.

Denoting a noncentral χ^2 variable, as defined in (1) by $\chi_v^2(\lambda)$, the probability that it exceeds X can be expressed as a series in central χ^2 probabilities, as follows:

$$(2) \quad P_v[\chi_v^2(\lambda) > X] = \sum_{j=0}^{\infty} a_{j,\lambda} P_v[\chi_{v+2j}^2 > X]$$

where $a_{j,\lambda} = e^{-\frac{1}{2}\lambda} (\frac{1}{2}\lambda)^j / j!$

and χ_f^2 is used to denote a (central) χ^2 with f degrees of freedom (i.e., $\chi_f^2(0)$).

The tables contain values of X such that

$$Q_{v,\lambda}(X) = Q.$$

for $Q = 0.999, 0.9975, 0.995, 0.99, 0.975, 0.95, 0.9, 0.75, 0.5, 0.25, 0.1, 0.05, 0.025, 0.01, 0.005, 0.0025, 0.001$.

Values of X are given to four significant figures.

2. Calculation of Tables

Equation (2) above can be written

$$(3) \quad Q_{v,\lambda}(X) = \sum_{j=0}^{\infty} a_{j,\lambda} f_{v+2j}(X)$$

with

$$f_m(X) = [2^{\frac{1}{2}m} \Gamma(\frac{1}{2}m)]^{-1} \int_X^{\infty} t^{\frac{1}{2}m-1} e^{-\frac{1}{2}t} dt$$

The method of solution of the equation

$$Q_{v,\lambda}(X) = Q$$

was iterative, based on Newton's method. At each stage of calculation, a trial value of X , X_r say, was used, and $Q_{v,\lambda}(X_r)$ calculated. The next trial value was

$$X_{r+1} = X_r + \frac{Q - Q_{v,\lambda}(X_r)}{\partial Q_{v,\lambda}(X_r) / \partial X_r}$$

where

$$\partial Q_{v,\lambda}(X_r) / \partial X_r = \sum_{j=0}^{\infty} a_{j,\lambda} [\partial f_{v+2j}(X_r) / \partial X_r]$$

and $\partial f_m(X) / \partial X = - [2^{\frac{1}{2}m} \Gamma(\frac{1}{2}m)]^{-1} X^{\frac{1}{2}m-1} e^{-\frac{1}{2}X}$.

The process was continued until the inequality

$$\left| \frac{Q - Q_{v,\lambda}(X_r)}{X_r \cdot \partial Q_{v,\lambda}(X_r) / \partial X_r} \right| < 0.0001$$

was satisfied - i.e. until the correction was less than 0.01% of the trial value. The value of X_{r+1} was then recorded as the required value of X . The recorded values should be correct to 1 in the fourth significant figure. Judging from detailed study of successive iterations in a number of particular cases, most of the figures should be accurate to the fourth significant figure.

The initial value, X_1 , was obtained from the value of X for the

same ν and Q , but for the previous (lower) value of λ by adding the correction

$$- (\text{increase in } \lambda) \frac{\partial Q_{\nu, \lambda}(X) / \partial \lambda}{\partial Q_{\nu, \lambda}(X) / \partial x}$$

For the lowest value of λ (0.04), X_1 was taken to be equal to the appropriate percentile of the corresponding central χ^2 distribution

I would like to thank Mrs. Carol Newman for writing the program giving effect to these calculations.

3. Other Tables of Noncentral χ^2 Chi-Square Distributions.

The most extensive tables of noncentral chi-square distributions are those of Haynam et. al [1]. These include

(i) Values of $Q_{\nu, \lambda}(X)$ to 4 decimal places, with X equal to the upper 100 α % point of the central chi-square distribution with ν degrees of freedom, for

$$\alpha = 0.001, 0.005, 0.01, 0.025, 0.05, 0.1$$

$$\lambda = 0(0.1)1.0(0.2)3.0(0.5)5(1)40(2)50(5)100$$

$$\nu = 1(1)30(2)50(5)100$$

(ii) Values of λ , to 3 decimal places, satisfying

$$Q_{\nu, \lambda}(X) = Q$$

for the same values of ν and X as in (i), with

$$Q = 0.01(0.01)0.30(0.02)0.90$$

(iii) Values of ν , to three decimal places, satisfying

$$Q_{\nu, \lambda}(X) = Q$$

for the same fixed values of λ , X and Q as in (i) and (ii)

More detailed tables (e.g [2], [3], [4]) of $Q_{v,\lambda}(X)$ [or $(1-Q_{v,\lambda}(X))$] for $v = 2$ or $v = 3$ have been calculated in correction with 'coverage' problems.

REFERENCES

- [1] Haynam, G. E., Govindarajulu, Z. and Leone, F. C. (1962) Tables of the Cumulative Non-Central Chi-Square Distribution, Case Statistical Laboratory, Report No. 104.
- [2] Guenther, W. C. (1961) On the probability of capturing a randomly selected point in three dimensions, SIAM Rev., 3, 247-250.
- [3] Lowe, J. R. (1960) A table of the integral of the bivariate normal distribution over an offset circle, J. R. Statist. Soc., Series B, 22, 177-187.
- [4] Owen, D. B. (1962) Handbook of Statistical Tables, Addison-Wesley, Reading, Mass.

$\frac{Q}{\lambda}$ 0.999 0.9975 0.995 0.99 0.975 0.95 0.9 0.75 0.5 0.25 0.1 0.05 0.025 0.01 0.005 0.0025 0.001

$\sqrt{\lambda} = 0.2$

1	1.635×10^{-6}	1.022×10^{-5}	4.087×10^{-5}	1.635×10^{-4}	0.001022	0.004093	0.01644	0.1057	0.4734	1.377	2.814	3.994	5.222	6.894	8.185	9.492	11.24
2	0.002041	0.005107	0.01023	0.02051	0.05166	0.1047	0.2150	0.5869	1.414	2.828	4.697	6.111	7.524	9.392	10.81	12.22	14.09
3	0.02463	0.04555	0.07269	0.1164	0.2187	0.3566	0.5922	1.229	2.398	4.163	6.334	7.919	9.472	11.49	13.01	14.51	16.48
4	0.09172	0.1463	0.2091	0.3001	0.4893	0.7179	1.074	1.942	3.390	5.439	7.857	9.582	11.25	13.41	15.01	16.59	18.65
5	0.2119	0.3100	0.4151	0.5588	0.8379	1.155	1.623	2.696	4.386	6.679	9.310	11.16	12.93	15.21	16.88	18.53	20.68
6	0.3836	0.5301	0.6802	0.8779	1.246	1.646	2.219	3.478	5.383	7.893	10.72	12.67	14.55	16.92	18.67	20.38	22.61
7	0.6019	0.7990	0.9949	1.246	1.700	2.180	2.849	4.280	6.382	9.088	12.08	14.15	16.10	18.58	20.39	22.17	24.46
8	0.8614	1.110	1.351	1.655	2.191	2.746	3.507	5.096	7.381	10.27	13.43	15.58	17.62	20.19	22.06	23.89	26.26
9	1.157	1.457	1.743	2.097	2.712	3.340	4.187	5.925	8.380	11.44	14.75	16.99	19.11	21.76	23.69	25.58	28.00
10	1.485	1.835	2.164	2.568	3.260	3.956	4.885	6.764	9.379	12.60	16.05	18.38	20.56	23.30	25.29	27.22	29.71
11	1.841	2.240	2.613	3.065	3.830	4.591	5.598	7.612	10.38	13.75	17.34	19.75	22.00	24.81	26.85	28.83	31.38
12	2.222	2.670	3.084	3.583	4.419	5.244	6.325	8.467	11.38	14.89	18.61	21.09	23.41	26.30	28.39	30.42	33.02
15	3.492	4.081	4.613	5.243	6.279	7.280	8.570	11.07	14.38	18.29	22.37	25.06	27.56	30.66	32.89	35.04	37.80
20	5.933	6.737	7.449	8.277	9.610	10.87	12.47	15.48	19.38	23.88	28.47	31.47	34.24	37.64	40.08	42.42	45.41

$\sqrt{\lambda} = 0.4$

1	1.843×10^{-6}	1.152×10^{-5}	4.608×10^{-5}	1.843×10^{-4}	0.001152	0.004614	0.01853	0.1191	0.5327	1.544	3.139	4.439	5.784	7.602	8.999	10.41	12.28
2	0.002168	0.005423	0.01086	0.02177	0.05485	0.1111	0.2282	0.6230	1.500	2.997	4.971	6.461	7.949	9.912	11.39	12.87	14.83
3	0.02563	0.04740	0.07565	0.1211	0.2276	0.3711	0.6163	1.279	2.494	4.328	6.582	8.225	9.836	11.93	13.50	15.05	17.09
4	0.09451	0.1508	0.2154	0.3092	0.5042	0.7397	1.107	2.001	3.492	5.601	8.089	9.863	11.58	13.80	15.44	17.06	19.18
5	0.2171	0.3175	0.4251	0.5723	0.8582	1.183	1.662	2.761	4.492	6.838	9.531	11.42	13.24	15.56	17.27	18.96	21.15
6	0.3914	0.5408	0.6940	0.8956	1.271	1.679	2.263	3.547	5.491	8.050	10.93	12.93	14.83	17.25	19.03	20.78	23.04
7	0.6123	0.8128	1.012	1.268	1.729	2.217	2.898	4.353	6.491	9.243	12.29	14.39	16.38	18.89	20.74	22.54	24.87
8	0.8743	1.126	1.371	1.680	2.224	2.787	3.560	5.172	7.491	10.42	13.63	15.82	17.88	20.49	22.39	24.24	26.64
9	1.173	1.476	1.766	2.125	2.749	3.384	4.242	6.004	8.491	11.59	14.94	17.22	19.36	22.05	24.01	25.91	28.37
10	1.503	1.857	2.190	2.599	3.299	4.003	4.943	6.845	9.491	12.75	16.24	18.60	20.81	23.58	25.59	27.54	30.06
11	1.861	2.265	2.641	3.098	3.872	4.642	5.659	7.695	10.49	13.90	17.53	19.96	22.24	25.08	27.14	29.15	31.72
12	2.244	2.697	3.115	3.618	4.463	5.296	6.388	8.551	11.49	15.04	18.80	21.30	23.65	26.56	28.67	30.72	33.35
15	3.520	4.113	4.650	5.285	6.329	7.339	8.639	11.15	14.49	18.44	22.54	25.26	27.78	30.90	33.15	35.32	38.10
20	5.968	6.777	7.493	8.327	9.668	10.94	12.54	15.58	19.49	24.02	28.64	31.66	34.44	37.87	40.32	42.67	45.68

λ 0.999 0.9975 0.995 0.99 0.975 0.95 0.9 0.75 0.5 0.25 0.1 0.05 0.025 0.01 0.005 0.0025 0.001
 $\sqrt{\lambda} = 0.6$

1	2.252×10^{-4}	1.407×10^{-3}	5.628×10^{-3}	2.251×10^{-2}	0.001407	0.005635	0.02262	0.1451	0.6444	1.839	3.671	5.132	6.621	8.609	10.12	11.63	13.64
2	0.002396	0.005993	0.01200	0.02406	0.06061	0.1228	0.2520	0.6871	1.650	3.282	5.419	7.021	8.613	10.70	12.28	13.84	15.91
3	0.02740	0.05067	0.08086	0.1295	0.2432	0.3965	0.6583	1.365	2.658	4.605	6.989	8.722	10.42	12.62	14.26	15.88	18.01
4	0.09935	0.1585	0.2264	0.3250	0.5299	0.7773	1.163	2.101	3.664	5.872	8.470	10.32	12.11	14.41	16.12	17.80	20.00
5	0.2259	0.3304	0.4424	0.5956	0.8930	1.230	1.729	2.871	4.669	7.103	9.894	11.85	13.73	16.13	17.90	19.64	21.90
6	0.4046	0.5591	0.7174	0.9258	1.313	1.736	2.339	3.665	5.672	8.311	11.28	13.33	15.30	17.79	19.62	21.41	23.74
7	0.6300	0.8363	1.041	1.304	1.779	2.281	2.981	4.477	6.675	9.501	12.63	14.78	16.82	19.40	21.29	23.14	25.53
8	0.8965	1.155	1.406	1.722	2.280	2.858	3.649	5.301	7.676	10.68	13.96	16.20	18.31	20.98	22.92	24.81	27.26
9	1.199	1.509	1.806	2.173	2.810	3.460	4.337	6.137	8.678	11.84	15.27	17.59	19.77	22.52	24.51	26.46	28.96
10	1.533	1.894	2.235	2.652	3.365	4.084	5.042	6.981	9.679	13.00	16.56	18.96	21.21	24.03	26.08	28.07	30.63
11	1.895	2.306	2.690	3.155	3.942	4.726	5.762	7.833	10.68	14.15	17.84	20.32	22.63	25.52	27.62	29.65	32.27
12	2.281	2.742	3.167	3.679	4.537	5.384	6.494	8.693	11.68	15.29	19.10	21.65	24.03	27.00	29.14	31.21	33.88
15	3.567	4.168	4.712	5.355	6.413	7.436	8.753	11.30	14.68	18.68	22.84	25.59	28.14	31.31	33.58	35.78	38.59
20	6.028	6.845	7.568	8.410	9.764	11.05	12.67	15.73	19.69	24.26	28.92	31.97	34.78	38.24	40.71	43.09	46.13

$\sqrt{\lambda} = 0.8$

1	2.979×10^{-6}	1.862×10^{-5}	7.448×10^{-5}	2.979×10^{-4}	0.001862	0.007454	0.02990	0.1906	0.8275	2.274	4.379	6.005	7.635	9.784	11.40	13.02	15.14
2	0.002756	0.006894	0.01380	0.02767	0.06968	0.1410	0.2892	0.7855	1.872	3.688	6.025	7.759	9.469	11.70	13.37	15.03	17.20
3	0.03007	0.05562	0.08875	0.1421	0.2668	0.4347	0.7212	1.492	2.896	4.995	7.545	9.388	11.18	13.51	15.23	16.94	19.17
4	0.1065	0.1699	0.2428	0.3484	0.5678	0.8327	1.245	2.246	3.911	6.251	8.994	10.94	12.82	15.23	17.01	18.77	21.06
5	0.2389	0.3493	0.4677	0.6296	0.9437	1.300	1.827	3.030	4.921	7.475	10.39	12.44	14.40	16.90	18.74	20.54	22.89
6	0.4238	0.5856	0.7514	0.9696	1.375	1.817	2.448	3.834	5.928	8.677	11.76	13.90	15.93	18.51	20.41	22.26	24.67
7	0.6556	0.8702	1.083	1.357	1.850	2.372	3.100	4.653	6.933	9.862	13.10	15.32	17.43	20.09	22.04	23.94	26.40
8	0.9282	1.196	1.456	1.783	2.360	2.958	3.776	5.484	7.937	11.04	14.42	16.72	18.90	21.64	23.64	25.59	28.10
9	1.236	1.556	1.862	2.241	2.898	3.567	4.471	6.325	8.940	12.20	15.72	18.10	20.34	23.16	25.21	27.20	29.77
10	1.576	1.948	2.297	2.726	3.460	4.198	5.182	7.174	9.944	13.35	17.00	19.46	21.77	24.65	26.75	28.79	31.41
11	1.943	2.365	2.758	3.235	4.042	4.846	5.908	8.031	10.95	14.50	18.27	20.80	23.17	26.13	28.27	30.35	33.02
12	2.335	2.806	3.241	3.765	4.643	5.509	6.645	8.893	11.95	15.64	19.53	22.13	24.56	27.59	29.77	31.89	34.61
15	3.634	4.246	4.800	5.456	6.533	7.574	8.915	11.51	14.95	19.02	23.25	26.05	28.65	31.86	34.18	36.41	39.27
20	6.113	6.940	7.674	8.527	9.900	11.20	12.84	15.95	19.96	24.59	29.32	32.41	35.26	38.76	41.26	43.67	46.74

λ 0.999 0.9975 0.995 0.99 0.975 0.95 0.9 0.75 0.5 0.25 0.1 0.05 0.025 0.01 0.005 0.0025 0.001

$\sqrt{\lambda} = 1.0$

1	4.270×10^{-6}	2.669×10^{-5}	1.067×10^{-4}	4.270×10^{-4}	0.002669	0.01067	0.04270	0.2675	1.104	2.842	5.219	7.002	8.765	11.07	12.79	14.49	16.73
2	0.003299	0.008252	0.01652	0.03311	0.08330	0.1684	0.3443	0.9272	2.177	4.210	6.770	8.642	10.47	12.85	14.62	16.36	18.65
3	0.03390	0.06268	0.1000	0.1600	0.3003	0.4887	0.8093	1.667	3.213	5.496	8.237	10.20	12.11	14.56	16.38	18.17	20.50
4	0.1165	0.1858	0.2654	0.3808	0.6202	0.9087	1.357	2.442	4.235	6.738	9.650	11.71	13.69	16.22	18.09	19.92	22.31
5	0.2566	0.3752	0.5022	0.6758	1.013	1.394	1.957	3.241	5.250	7.952	11.03	13.17	15.22	17.83	19.75	21.63	24.07
6	0.4498	0.6214	0.7973	1.029	1.458	1.926	2.593	4.056	6.261	9.146	12.37	14.60	16.72	19.41	21.37	23.30	25.79
7	0.6899	0.9156	1.140	1.427	1.945	2.494	3.257	4.884	7.269	10.33	13.69	16.00	18.19	20.95	22.97	24.93	27.47
8	0.9705	1.250	1.522	1.863	2.466	3.090	3.943	5.723	8.275	11.49	15.00	17.39	19.64	22.47	24.53	26.54	29.13
9	1.286	1.619	1.937	2.330	3.013	3.709	4.647	6.570	9.281	12.65	16.29	18.75	21.06	23.96	26.07	28.12	30.76
10	1.633	2.018	2.380	2.824	3.583	4.347	5.366	7.425	10.28	13.80	17.56	20.09	22.47	25.44	27.59	29.68	32.37
11	2.007	2.443	2.849	3.341	4.174	5.003	6.098	8.286	11.29	14.94	18.82	21.43	23.86	26.89	29.09	31.22	33.95
12	2.405	2.890	3.338	3.877	4.781	5.673	6.841	9.153	12.29	16.08	20.08	22.74	25.23	28.33	30.57	32.74	35.52
15	3.721	4.348	4.915	5.586	6.688	7.754	9.126	11.78	15.30	19.46	23.78	26.64	29.29	32.57	34.93	37.21	40.12
20	6.222	7.065	7.812	8.680	10.08	11.40	13.07	16.23	20.31	25.02	29.82	32.97	35.86	39.42	41.96	44.41	47.53

$\sqrt{\lambda} = 1.2$

1	6.630×10^{-6}	4.144×10^{-5}	1.637×10^{-4}	6.629×10^{-4}	0.004141	0.01653	0.06568	0.3947	1.487	3.526	6.161	8.094	9.986	12.44	14.26	16.06	18.41
2	0.004110	0.01028	0.02057	0.04121	0.1035	0.2086	0.4240	1.123	2.571	4.844	7.634	9.646	11.60	14.12	15.98	17.82	20.21
3	0.03924	0.07253	0.1156	0.1849	0.3464	0.5626	0.9283	1.896	3.613	6.103	9.052	11.15	13.17	15.75	17.66	19.54	21.98
4	0.1300	0.2072	0.2959	0.4242	0.6899	1.009	1.504	2.694	4.640	7.329	10.43	12.61	14.69	17.35	19.31	21.22	23.71
5	0.2800	0.4092	0.5476	0.7365	1.102	1.516	2.125	3.508	5.659	8.531	11.78	14.03	16.18	18.91	20.91	22.87	25.41
6	0.4837	0.6679	0.8566	1.105	1.565	2.066	2.778	4.336	6.673	9.717	13.10	15.44	17.65	20.45	22.49	24.49	27.08
7	0.7340	0.9739	1.212	1.517	2.067	2.648	3.456	5.174	7.684	10.89	14.41	16.82	19.09	21.96	24.05	26.09	28.72
8	1.025	1.319	1.606	1.966	2.600	3.256	4.153	6.021	8.692	12.05	15.70	18.18	20.51	23.45	25.58	27.66	30.33
9	1.350	1.699	2.032	2.444	3.158	3.886	4.867	6.875	9.699	13.20	16.97	19.52	21.92	24.91	27.09	29.21	31.93
10	1.705	2.107	2.485	2.948	3.739	4.535	5.595	7.736	10.71	14.35	18.24	20.85	23.30	26.37	28.58	30.74	33.50
11	2.088	2.540	2.962	3.473	4.338	5.199	6.334	8.602	11.71	15.49	19.49	22.17	24.68	27.80	30.06	32.25	35.06
12	2.494	2.996	3.460	4.018	4.954	5.876	7.084	9.473	12.71	16.62	20.73	23.48	26.04	29.22	31.52	33.75	36.60
15	3.830	4.475	5.058	5.748	6.881	7.977	9.386	12.11	15.72	19.99	24.42	27.35	30.06	33.41	35.83	38.16	41.14
20	6.359	7.219	7.982	8.868	10.30	11.65	13.35	16.58	20.73	25.54	30.44	33.64	36.59	40.21	42.80	45.29	48.47

λ 0.999 0.9975 0.995 0.99 0.975 0.95 0.9 0.75 0.5 0.25 0.1 0.05 0.025 0.01 0.005 0.0025 0.001

$\sqrt{\lambda} = 1.4$

1	1.115×10^{-5}	6.970×10^{-5}	2.788×10^{-4}	0.001115	0.006954	0.02764	0.1079	0.5957	1.978	4.307	7.191	9.271	11.29	13.88	15.81	17.70	20.16
2	0.005329	0.01332	0.02665	0.05331	0.1334	0.2672	0.5372	1.384	3.056	5.580	8.603	10.76	12.83	15.49	17.45	19.38	21.89
3	0.04663	0.08612	0.1372	0.2191	0.4091	0.6618	1.085	2.188	4.100	6.814	9.977	12.20	14.34	17.06	19.07	21.03	23.58
4	0.1479	0.2355	0.3360	0.4811	0.7808	1.139	1.692	3.006	5.129	8.022	11.32	13.62	15.82	18.61	20.66	22.66	25.25
5	0.3102	0.4531	0.6059	0.8142	1.217	1.670	2.335	3.836	6.150	9.212	12.65	15.02	17.28	20.13	22.22	24.26	26.89
6	0.5267	0.7269	0.9318	1.201	1.699	2.239	3.007	4.676	7.166	10.39	13.95	16.40	18.71	21.63	23.75	25.83	28.51
7	0.7895	1.047	1.302	1.629	2.218	2.838	3.669	5.524	8.178	11.55	15.24	17.75	20.12	23.10	25.27	27.39	30.11
8	1.092	1.406	1.710	2.092	2.765	3.461	4.409	6.380	9.189	12.71	16.51	19.09	21.52	24.56	26.77	28.92	31.69
9	1.428	1.797	2.148	2.583	3.336	4.103	5.134	7.241	10.20	13.85	17.78	20.42	22.90	26.01	28.26	30.44	33.25
10	1.794	2.216	2.613	3.098	3.928	4.762	5.871	8.109	11.20	14.99	19.03	21.74	24.27	27.43	29.72	31.94	34.79
11	2.186	2.660	3.100	3.635	4.538	5.435	6.619	8.981	12.21	16.13	20.27	23.04	25.63	28.85	31.18	33.43	36.32
12	2.601	3.125	3.608	4.189	5.163	6.122	7.377	9.857	13.22	17.26	21.51	24.34	26.97	30.25	32.62	34.91	37.84
15	3.962	4.628	5.231	5.943	7.113	8.244	9.698	12.51	16.23	20.62	25.17	28.17	30.96	34.40	36.87	39.26	42.31
20	6.522	7.404	8.186	9.094	10.56	11.94	13.69	16.99	21.24	26.15	31.16	34.43	37.44	41.14	43.78	46.32	49.56

$\sqrt{\lambda} = 1.6$

1	2.032×10^{-5}	1.270×10^{-4}	5.079×10^{-4}	0.002030	0.01262	0.04953	0.1855	0.8887	2.565	5.174	8.303	10.53	12.67	15.42	17.44	19.42	22.00
2	0.007190	0.01796	0.03588	0.07159	0.1778	0.3523	0.6950	1.719	3.631	6.411	9.667	11.96	14.16	16.96	19.02	21.04	23.66
3	0.05686	0.1049	0.1668	0.2657	0.4936	0.7931	1.288	2.548	4.673	7.621	11.01	13.37	15.62	18.48	20.58	22.63	25.29
4	0.1714	0.2727	0.3885	0.5552	0.8976	1.304	1.926	3.385	5.702	8.813	12.32	14.75	17.06	19.98	22.12	24.21	26.91
5	0.3489	0.5091	0.6800	0.9123	1.360	1.861	2.593	4.229	6.724	9.990	13.62	16.12	18.48	21.46	23.64	25.76	28.50
6	0.5806	0.8006	1.025	1.320	1.864	2.452	3.283	5.081	7.741	11.15	14.91	17.47	19.89	22.93	25.14	27.30	30.08
7	0.8580	1.137	1.413	1.767	2.401	3.068	3.991	5.939	8.755	12.31	16.18	18.80	21.27	24.37	26.63	28.82	31.64
8	1.174	1.511	1.837	2.246	2.964	3.706	4.715	6.803	9.766	13.46	17.44	20.13	22.65	25.81	28.10	30.32	33.18
9	1.523	1.916	2.289	2.751	3.550	4.361	5.451	7.672	10.78	14.60	18.69	21.44	24.01	27.23	29.55	31.81	34.71
10	1.901	2.347	2.767	3.279	4.154	5.032	6.199	8.546	11.78	15.73	19.93	22.74	25.36	28.63	31.00	33.29	36.23
11	2.305	2.803	3.266	3.827	4.775	5.716	6.956	9.424	12.79	16.86	21.16	24.03	26.70	30.03	32.43	34.75	37.73
12	2.730	3.279	3.784	4.392	5.410	6.412	7.722	10.31	13.80	17.99	22.39	25.31	28.03	31.41	33.85	36.20	39.22
15	4.118	4.809	5.435	6.174	7.387	8.558	10.06	12.97	16.81	21.34	26.02	29.12	31.98	35.51	38.05	40.50	43.63
20	6.714	7.621	8.425	9.359	10.86	12.28	14.08	17.46	21.83	26.86	31.99	35.33	38.40	42.19	44.89	47.49	50.80

$\nu \backslash Q$ 0.999 0.9975 0.995 0.99 0.975 0.95 0.9 0.75 0.5 0.25 0.1 0.05 0.025 0.01 0.005 0.0025 0.001

$\sqrt{\lambda} = 1.8$

1	4.011×10^{-5}	2.506×10^{-4}	0.001002	0.003999	0.02461	0.09367	0.3225	1.279	3.241	6.123	9.496	11.87	14.14	17.03	19.15	21.22	23.91
2	0.01009	0.02517	0.05015	0.09957	0.2440	0.4744	0.9093	2.133	4.295	7.332	10.82	13.26	15.58	18.52	20.68	22.79	25.52
3	0.07113	0.1309	0.2077	0.3293	0.6063	0.9645	1.545	2.982	5.332	8.522	12.13	14.63	17.00	20.00	22.20	24.34	27.10
4	0.2024	0.3214	0.4568	0.6508	1.046	1.511	2.213	3.834	6.360	9.698	13.42	15.98	18.41	21.46	23.69	25.87	28.67
5	0.3981	0.5799	0.7732	1.035	1.536	2.095	2.903	4.691	7.381	10.86	14.70	17.32	19.80	22.91	25.18	27.38	30.23
6	0.6477	0.8919	1.141	1.466	2.064	2.707	3.612	5.554	8.399	12.02	15.97	18.65	21.17	24.34	26.65	28.88	31.76
7	0.9420	1.247	1.548	1.933	2.621	3.342	4.336	6.422	9.413	13.16	17.22	19.96	22.54	25.76	28.10	30.37	33.29
8	1.274	1.637	1.989	2.429	3.202	3.996	5.074	7.294	10.43	14.30	18.47	21.27	23.89	27.17	29.54	31.85	34.80
9	1.638	2.058	2.457	2.951	3.802	4.665	5.822	8.170	11.44	15.44	19.70	22.56	25.23	28.57	30.97	33.31	36.30
10	2.029	2.503	2.949	3.493	4.420	5.348	6.580	9.050	12.44	16.57	20.93	23.85	26.57	29.95	32.39	34.76	37.79
11	2.445	2.972	3.461	4.054	5.053	6.044	7.346	9.934	13.45	17.69	22.15	25.13	27.89	31.33	33.80	36.20	39.27
12	2.882	3.459	3.991	4.630	5.699	6.749	8.121	10.82	14.46	18.81	23.37	26.40	29.21	32.69	35.21	37.63	40.74
15	4.300	5.021	5.672	6.441	7.703	8.920	10.48	13.50	17.47	22.15	26.98	30.17	33.11	36.75	39.36	41.87	45.08
20	6.937	7.872	8.701	9.664	11.21	12.68	14.52	18.01	22.49	27.66	32.92	36.35	39.50	43.37	46.13	48.79	52.17

$\sqrt{\lambda} = 2.0$

1	8.576×10^{-5}	5.357×10^{-4}	0.002139	0.008504	0.05098	0.1808	0.5417	1.761	4.000	7.153	10.77	13.28	15.68	18.72	20.94	23.11	25.91
2	0.01472	0.03661	0.07259	0.1428	0.3419	0.6456	1.190	2.628	5.044	8.339	12.06	14.64	17.08	20.17	22.43	24.63	27.47
3	0.09120	0.1672	0.2640	0.4158	0.7552	1.184	1.864	3.491	6.076	9.512	13.35	15.98	18.47	21.62	23.91	26.14	29.01
4	0.2433	0.3850	0.5453	0.7732	1.232	1.765	2.558	4.356	7.102	10.67	14.62	17.31	19.85	23.04	25.37	27.63	30.54
5	0.4606	0.6691	0.8898	1.187	1.752	2.376	3.271	5.225	8.122	11.83	15.87	18.63	21.21	24.46	26.82	29.11	32.06
6	0.7307	1.004	1.282	1.643	2.304	3.011	3.998	6.097	9.139	12.97	17.12	19.93	22.57	25.87	28.26	30.58	33.56
7	1.044	1.380	1.711	2.132	2.882	3.664	4.738	6.973	10.15	14.11	18.36	21.23	23.91	27.26	29.69	32.04	35.06
8	1.394	1.789	2.170	2.647	3.480	4.334	5.488	7.853	11.17	15.24	19.60	22.52	25.24	28.64	31.10	33.49	36.54
9	1.774	2.226	2.656	3.185	4.097	5.018	6.249	8.736	12.18	16.37	20.82	23.79	26.57	30.02	32.51	34.92	38.01
10	2.180	2.687	3.163	3.742	4.729	5.714	7.017	9.622	13.19	17.50	22.04	25.07	27.88	31.39	33.91	36.35	39.48
11	2.609	3.169	3.689	4.317	5.374	6.420	7.793	10.51	14.19	18.61	23.25	26.33	29.19	32.74	35.30	37.77	40.93
12	3.059	3.670	4.232	4.906	6.032	7.136	8.577	11.40	15.20	19.73	24.46	27.59	30.49	34.09	36.68	39.18	42.38
15	4.511	5.264	5.945	6.748	8.065	9.334	10.96	14.09	18.22	23.06	28.05	31.33	34.36	38.10	40.79	43.37	46.67
20	7.191	8.159	9.016	10.01	11.61	13.12	15.03	18.62	23.24	28.55	33.95	37.47	40.70	44.67	47.50	50.22	53.68

λ 0.999 0.9975 0.995 0.99 0.975 0.95 0.9 0.75 0.5 0.25 0.1 0.05 0.025 0.01 0.005 0.0025 0.001

$\sqrt{\lambda} = 2.2$

1	1.986 × 10 ⁻⁴	0.001240	0.004935	0.01938	0.1086	0.3374	0.8529	2.328	4.840	8.263	12.12	14.78	17.31	20.49	22.81	25.07	27.99
2	0.02232	0.05516	0.1083	0.2097	0.4836	0.8774	1.544	3.204	5.876	9.430	13.39	16.11	18.68	21.91	24.26	26.55	29.51
3	0.1197	0.2180	0.3416	0.5325	0.9487	1.460	2.248	4.079	6.904	10.59	14.65	17.42	20.04	23.32	25.71	28.03	31.01
4	0.2972	0.4680	0.6594	0.9288	1.463	2.078	2.968	4.954	7.927	11.74	15.90	18.73	21.39	24.72	27.14	29.49	32.51
5	0.5396	0.7809	1.035	1.374	2.013	2.710	3.700	5.832	8.946	12.88	17.14	20.03	22.73	26.11	28.56	30.94	33.99
6	0.8330	1.141	1.453	1.856	2.589	3.366	4.444	6.713	9.962	14.02	18.38	21.31	24.06	27.49	29.97	32.38	35.47
7	1.168	1.539	1.905	2.367	3.188	4.039	5.199	7.597	10.98	15.15	19.60	22.59	25.38	28.86	31.38	33.81	36.93
8	1.536	1.968	2.384	2.903	3.804	4.725	5.963	8.483	11.99	16.27	20.82	23.86	26.70	30.23	32.77	35.24	38.39
9	1.934	2.424	2.887	3.458	4.437	5.423	6.735	9.373	13.00	17.40	22.04	25.13	28.01	31.58	34.16	36.65	39.84
10	2.356	2.901	3.411	4.031	5.083	6.131	7.514	10.27	14.01	18.51	23.24	26.39	29.31	32.93	35.54	38.06	41.28
11	2.801	3.398	3.952	4.619	5.742	6.849	8.299	11.16	15.02	19.63	24.45	27.64	30.60	34.27	36.91	39.46	42.71
12	3.264	3.912	4.508	5.222	6.411	7.576	9.091	12.06	16.02	20.74	25.64	28.89	31.89	35.61	38.27	40.85	44.14
15	4.752	5.543	6.256	7.098	8.475	9.800	11.50	14.76	19.04	24.06	29.21	32.60	35.72	39.57	42.33	44.99	48.37
20	7.479	8.483	9.372	10.40	12.06	13.62	15.59	19.30	24.07	29.54	35.08	38.70	42.01	46.08	48.98	51.76	55.31

$\sqrt{\lambda} = 2.4$

1	4.981 × 10 ⁻⁴	0.003100	0.01222	0.04637	0.2243	0.5817	1.254	2.978	5.760	9.452	13.55	16.36	19.01	22.34	24.76	27.11	30.14
2	0.03506	0.08564	0.1654	0.3115	0.6814	1.178	1.974	3.861	6.790	10.61	14.80	17.66	20.35	23.73	26.18	28.57	31.63
3	0.1603	0.2892	0.4480	0.6879	1.195	1.799	2.704	4.744	7.814	11.75	16.04	18.96	21.69	25.11	27.60	30.01	33.10
4	0.3684	0.5759	0.8053	1.124	1.746	2.441	3.444	5.628	8.835	12.89	17.28	20.24	23.02	26.49	29.00	31.44	34.57
5	0.6393	0.9203	1.213	1.602	2.324	3.102	4.195	6.514	9.853	14.02	18.50	21.52	24.34	27.86	30.40	32.86	36.03
6	0.9583	1.308	1.659	2.110	2.924	3.779	4.955	7.403	10.87	15.15	19.72	22.79	25.65	29.21	31.79	34.28	37.47
7	1.316	1.730	2.134	2.644	3.543	4.469	5.723	8.293	11.88	16.27	20.94	24.05	26.96	30.57	33.17	35.69	38.92
8	1.706	2.180	2.635	3.200	4.178	5.171	6.499	9.186	12.89	17.39	22.14	25.31	28.25	31.91	34.54	37.09	40.35
9	2.122	2.654	3.157	3.773	4.826	5.883	7.283	10.08	13.90	18.51	23.35	26.56	29.55	33.25	35.91	38.48	41.77
10	2.562	3.149	3.697	4.362	5.487	6.604	8.072	10.98	14.91	19.62	24.54	27.81	30.83	34.58	37.27	39.87	43.19
11	3.022	3.661	4.253	4.965	6.159	7.334	8.867	11.88	15.92	20.73	25.74	29.05	32.11	35.90	38.63	41.25	44.61
12	3.500	4.190	4.823	5.581	6.840	8.071	9.667	12.78	16.93	21.84	26.93	30.28	33.39	37.22	39.97	42.63	46.01
15	5.026	5.858	6.608	7.491	8.935	10.32	12.10	15.50	19.95	25.14	30.47	33.97	37.18	41.15	43.99	46.72	50.19
20	7.802	8.846	9.770	10.84	12.56	14.18	16.22	20.06	24.97	30.61	36.32	40.03	43.43	47.60	50.57	53.43	57.05

χ^2 0.999 0.9975 0.995 0.99 0.975 0.95 0.9 0.75 0.5 0.25 0.1 0.05 0.025 0.01 0.005 0.0025 0.001

$\sqrt{\lambda} = 2.6$

1	0.001352	0.008335	0.03189	0.1106	0.4223	0.9158	1.739	3.708	6.760	10.72	15.07	18.02	20.79	24.27	26.79	29.24	32.38
2	0.05682	0.1359	0.2551	0.4613	0.9449	1.552	2.482	4.598	7.785	11.86	16.30	19.30	22.12	25.64	28.19	30.66	33.84
3	0.2186	0.3881	0.5917	0.8908	1.501	2.205	3.232	5.487	8.807	13.00	17.52	20.57	23.43	27.00	29.58	32.08	35.28
4	0.4622	0.7149	0.9901	1.366	2.085	2.873	3.991	6.379	9.825	14.13	18.74	21.84	24.74	28.35	30.96	33.48	36.72
5	0.7645	1.093	1.431	1.875	2.690	3.556	4.758	7.272	10.84	15.25	19.95	23.10	26.04	29.69	32.33	34.88	38.15
6	1.111	1.509	1.905	2.410	3.313	4.252	5.532	8.167	11.86	16.37	21.16	24.36	27.33	31.03	33.70	36.28	39.58
7	1.494	1.956	2.404	2.967	3.952	4.959	6.313	9.064	12.87	17.49	22.36	25.61	28.62	32.37	35.06	37.67	41.00
8	1.905	2.428	2.926	3.543	4.604	5.675	7.101	9.963	13.88	18.60	23.56	26.85	29.91	33.69	36.42	39.05	42.41
9	2.341	2.921	3.467	4.134	5.269	6.401	7.895	10.86	14.89	19.71	24.75	28.09	31.18	35.01	37.77	40.42	43.81
10	2.799	3.434	4.024	4.739	5.944	7.135	8.694	11.77	15.90	20.82	25.94	29.32	32.46	36.33	39.11	41.79	45.21
11	3.276	3.963	4.596	5.357	6.628	7.876	9.498	12.67	16.91	21.92	27.12	30.55	33.72	37.64	40.45	43.15	46.61
12	3.769	4.506	5.181	5.986	7.322	8.623	10.31	13.58	17.92	23.03	28.31	31.78	34.99	38.94	41.78	44.51	47.99
15	5.335	6.212	7.002	7.932	9.448	10.90	12.76	16.31	20.93	26.32	31.83	35.43	38.75	42.83	45.75	48.56	52.13
20	8.164	9.251	10.21	11.33	13.11	14.79	16.91	20.98	25.96	31.77	37.64	41.46	44.95	49.23	52.28	55.20	58.92

$\sqrt{\lambda} = 2.8$

1	0.003955	0.02364	0.08309	0.2420	0.7095	1.335	2.306	4.518	7.840	12.07	16.66	19.76	22.66	26.28	28.90	31.44	34.70
2	0.09428	0.2172	0.3907	0.6710	1.280	2.002	3.067	5.414	8.861	13.20	17.87	21.02	23.96	27.62	30.27	32.84	36.13
3	0.3014	0.5235	0.7815	1.149	1.872	2.681	3.835	6.310	9.880	14.33	19.08	22.28	25.26	28.96	31.64	34.23	37.55
4	0.5848	0.8923	1.220	1.661	2.485	3.372	4.610	7.208	10.90	15.45	20.29	23.53	26.55	30.30	33.00	35.62	38.96
5	0.9209	1.304	1.694	2.200	3.115	4.075	5.391	8.108	11.91	16.56	21.49	24.77	27.83	31.62	34.36	37.00	40.37
6	1.297	1.749	2.196	2.761	3.760	4.788	6.178	9.008	12.92	17.68	22.69	26.02	29.11	32.94	35.70	38.37	41.78
7	1.705	2.221	2.719	3.340	4.418	5.511	6.972	9.911	13.94	18.79	23.88	27.25	30.38	34.26	37.05	39.74	43.17
8	2.139	2.715	3.262	3.935	5.087	6.242	7.770	10.82	14.95	19.90	25.06	28.48	31.65	35.57	38.39	41.10	44.57
9	2.596	3.229	3.822	4.544	5.767	6.980	8.574	11.72	15.96	21.00	26.25	29.71	32.92	36.88	39.72	42.46	45.95
10	3.072	3.759	4.397	5.166	6.456	7.726	9.382	12.63	16.97	22.10	27.43	30.94	34.18	38.18	41.05	43.81	47.33
11	3.566	4.305	4.984	5.798	7.153	8.478	10.19	13.54	17.97	23.20	28.60	32.16	35.43	39.47	42.37	45.16	48.71
12	4.075	4.864	5.584	6.441	7.859	9.236	11.01	14.45	18.98	24.30	29.78	33.37	36.68	40.77	43.69	46.50	50.08
15	5.682	6.610	7.443	8.421	10.02	11.54	13.48	17.19	22.00	27.58	33.28	37.00	40.42	44.62	47.62	50.50	54.17
20	8.565	9.700	10.70	11.86	13.72	15.47	17.66	21.78	27.02	33.02	39.06	42.99	46.57	50.96	54.09	57.09	60.89

\sqrt{Q} 0.999 0.9975 0.995 0.99 0.975 0.95 0.9 0.75 0.5 0.25 0.1 0.05 0.025 0.01 0.005 0.0025 0.001

$\sqrt{\lambda} = 3.0$

1	0.01232	0.06692	0.1967	0.4597	1.083	1.837	2.953	5.408	9.000	13.50	18.33	21.57	24.60	28.37	31.09	33.72	37.09
2	0.1579	0.3435	0.5848	0.9486	1.689	2.528	3.730	6.309	10.02	14.62	19.53	22.82	25.89	29.70	32.44	35.10	38.50
3	0.4177	0.7048	1.026	1.469	2.312	3.229	4.513	7.212	11.04	15.74	20.73	24.06	27.16	31.02	33.79	36.47	39.90
4	0.7433	1.115	1.503	2.014	2.951	3.941	5.302	8.115	12.05	16.85	21.92	25.20	28.44	32.33	35.13	37.84	41.29
5	1.114	1.560	2.008	2.581	3.603	4.662	6.096	9.020	13.06	17.96	23.11	26.53	29.71	33.64	36.47	39.20	42.68
6	1.520	2.034	2.536	3.166	4.268	5.391	6.895	9.926	14.08	19.07	24.30	27.76	30.97	34.95	37.80	40.55	44.06
7	1.954	2.531	3.083	3.767	4.944	6.128	7.699	10.83	15.09	20.17	25.48	28.99	32.23	36.25	39.13	41.90	45.44
8	2.412	3.047	3.647	4.381	5.629	6.873	8.508	11.74	16.10	21.28	26.66	30.21	33.49	37.54	40.45	43.25	46.82
9	2.889	3.581	4.226	5.008	6.324	7.623	9.321	12.65	17.11	22.38	27.83	31.43	34.74	38.83	41.77	44.59	48.19
10	3.385	4.129	4.818	5.645	7.026	8.380	10.14	13.56	18.11	23.47	29.00	32.64	35.99	40.12	43.08	45.93	49.55
11	3.896	4.692	5.421	6.292	7.736	9.142	10.96	14.48	19.12	24.57	30.17	33.85	37.24	41.41	44.39	47.26	50.91
12	4.422	5.266	6.035	6.948	8.453	9.910	11.78	15.39	20.13	25.66	31.34	35.06	38.48	42.69	45.69	48.59	52.27
15	6.070	7.051	7.931	8.963	10.64	12.24	14.28	18.14	23.15	28.93	34.82	38.66	42.18	46.50	49.59	52.55	56.31
20	9.008	10.19	11.24	12.45	14.38	16.20	18.48	22.75	28.18	34.36	40.58	44.61	48.30	52.80	56.01	59.08	62.97

$\sqrt{\lambda} = 3.2$

1	0.03909	0.1698	0.3952	0.7648	1.538	2.419	3.680	6.378	10.24	15.01	20.08	23.47	26.63	30.54	33.36	36.08	39.57
2	0.2614	0.5275	0.8459	1.298	2.174	3.131	4.472	7.285	11.26	16.12	21.27	24.71	27.89	31.85	34.69	37.44	40.95
3	0.5768	0.9397	1.331	1.854	2.823	3.852	5.268	8.192	12.27	17.23	22.46	25.93	29.16	33.15	36.02	38.79	42.33
4	0.9448	1.389	1.843	2.420	3.485	4.581	6.069	9.101	13.28	18.34	23.64	27.16	30.42	34.45	37.35	40.14	43.71
5	1.351	1.867	2.377	3.023	4.158	5.318	6.875	10.01	14.30	19.44	24.82	28.38	31.67	35.75	38.67	41.48	45.08
6	1.786	2.368	2.931	3.631	4.841	6.062	7.685	10.92	15.31	20.55	26.00	29.60	32.93	37.04	39.98	42.82	46.44
7	2.246	2.889	3.501	4.251	5.533	6.813	8.499	11.83	16.32	21.65	27.17	30.81	34.17	38.32	41.30	44.16	47.81
8	2.727	3.428	4.085	4.884	6.234	7.570	9.317	12.75	17.33	22.74	28.34	32.02	35.42	39.61	42.60	45.49	49.16
9	3.226	3.981	4.682	5.527	6.942	8.332	10.14	13.66	18.34	23.84	29.51	33.23	36.66	40.88	43.91	46.81	50.52
10	3.740	4.547	5.290	6.179	7.658	9.099	10.96	14.58	19.35	24.93	30.67	34.43	37.90	42.16	45.21	48.14	51.87
11	4.269	5.126	5.909	6.840	8.380	9.872	11.79	15.49	20.35	26.02	31.83	35.64	39.13	43.43	46.50	49.46	53.21
12	4.811	5.715	6.537	7.510	9.108	10.65	12.62	16.41	21.36	27.11	32.99	36.83	40.36	44.70	47.80	50.77	54.55
15	6.502	7.541	8.471	9.560	11.22	13.00	15.13	19.17	24.38	30.37	36.46	40.41	44.04	48.49	51.67	54.70	58.56
20	9.496	10.74	11.83	13.09	15.11	17.00	19.37	23.79	29.40	35.78	42.19	46.33	50.12	54.74	58.03	61.17	65.16

$\nu \backslash Q$ 0.999 0.9975 0.995 0.99 0.975 0.95 0.9 0.75 0.5 0.25 0.1 0.05 0.025 0.01 0.005 0.0025 0.001

$\sqrt{\lambda} = 3.4$

1	0.1132	0.3565	0.6806	1.153	2.074	3.081	4.488	7.428	11.56	16.60	21.92	25.45	28.73	32.79	35.71	38.53	42.13
2	0.4191	0.7782	1.179	1.722	2.735	3.812	5.292	8.340	12.57	17.71	23.10	26.67	29.98	34.08	37.03	39.87	43.49
3	0.7875	1.235	1.701	2.309	3.407	4.550	6.100	9.252	13.59	18.81	24.27	27.89	31.23	35.37	38.34	41.20	44.85
4	1.196	1.720	2.245	2.912	4.089	5.295	6.912	10.16	14.60	19.91	25.45	29.10	32.48	36.66	39.65	42.53	46.21
5	1.636	2.229	2.806	3.528	4.781	6.046	7.728	11.08	15.61	21.01	26.62	30.31	33.73	37.94	40.96	43.86	47.56
6	2.100	2.756	3.383	4.157	5.481	6.804	8.547	11.99	16.62	22.11	27.78	31.52	34.97	39.21	42.26	45.18	48.91
7	2.586	3.301	3.975	4.796	6.188	7.567	9.371	12.91	17.63	23.20	28.95	32.72	36.20	40.49	43.55	46.50	50.26
8	3.089	3.860	4.578	5.446	6.903	8.335	10.20	13.83	18.64	24.29	30.11	33.92	37.44	41.76	44.85	47.82	51.60
9	3.609	4.432	5.192	6.105	7.625	9.108	11.03	14.75	19.65	25.38	31.27	35.12	38.67	43.03	46.14	49.13	52.94
10	4.142	5.016	5.817	6.772	8.352	9.886	11.86	15.66	20.66	26.47	32.43	36.32	39.89	44.29	47.43	50.44	54.28
11	4.688	5.611	6.451	7.447	9.086	10.67	12.70	16.58	21.66	27.56	33.58	37.51	41.12	45.55	48.71	51.75	55.61
12	5.246	6.216	7.093	8.129	9.824	11.45	13.53	17.51	22.67	28.65	34.73	38.70	42.34	46.81	49.99	53.05	56.94
15	6.980	8.081	9.064	10.21	12.07	13.83	16.06	20.28	25.69	31.90	38.18	42.26	45.99	50.56	53.82	56.94	60.90
20	10.03	11.33	12.47	13.79	15.89	17.86	20.32	24.91	30.71	37.29	43.89	48.15	52.03	56.77	60.14	63.37	67.45

$\sqrt{\lambda} = 3.6$

1	0.2657	0.6299	1.049	1.622	2.690	3.823	5.375	8.559	12.96	18.27	23.83	27.51	30.91	35.12	38.14	41.05	44.76
2	0.6412	1.100	1.585	2.222	3.373	4.570	6.190	9.474	13.97	19.37	25.00	28.72	32.16	36.40	39.44	42.37	46.11
3	1.057	1.596	2.140	2.836	4.065	5.324	7.009	10.39	14.98	20.47	26.17	29.92	33.39	37.67	40.74	43.69	47.46
4	1.503	2.113	2.712	3.462	4.765	6.083	7.831	11.31	16.00	21.56	27.33	31.13	34.63	38.95	42.04	45.01	48.80
5	1.975	2.650	3.298	4.099	5.474	6.847	8.656	12.23	17.01	22.66	28.49	32.33	35.86	40.21	43.33	46.32	50.14
6	2.467	3.202	3.897	4.747	6.189	7.617	9.485	13.14	18.02	23.75	29.65	33.53	37.09	41.48	44.62	47.63	51.47
7	2.977	3.768	4.508	5.405	6.911	8.391	10.32	14.06	19.03	24.84	30.81	34.72	38.32	42.74	45.90	48.94	52.80
8	3.502	4.348	5.130	6.071	7.639	9.170	11.15	14.99	20.03	25.93	31.96	35.91	39.54	44.00	47.18	50.24	54.13
9	4.042	4.938	5.761	6.745	8.373	9.953	11.99	15.91	21.04	27.01	33.12	37.10	40.76	45.26	48.46	51.54	55.46
10	4.594	5.539	6.402	7.426	9.112	10.74	12.83	16.83	22.05	28.10	34.27	38.29	41.98	46.51	49.74	52.84	56.78
11	5.157	6.150	7.050	8.114	9.856	11.53	13.67	17.75	23.06	29.18	35.42	39.48	43.20	47.76	51.01	54.13	58.10
12	5.731	6.769	7.705	8.808	10.61	12.33	14.51	18.68	24.06	30.27	36.56	40.66	44.41	49.01	52.28	55.43	59.41
15	7.506	8.673	9.713	10.92	12.88	14.73	17.06	21.46	27.08	33.51	39.99	44.20	48.04	52.74	56.08	59.28	63.35
20	10.61	11.97	13.17	14.55	16.74	18.79	21.35	26.10	32.10	38.89	45.68	50.05	54.04	58.90	62.36	65.66	69.84

χ^2/Q 0.999 0.9975 0.995 0.99 0.975 0.95 0.9 0.75 0.5 0.25 0.1 0.05 0.025 0.01 0.005 0.0025 0.001

$\sqrt{\lambda} = 3.8$

1	0.5052	0.9862	1.499	2.172	3.386	4.645	6.343	9.769	14.44	20.02	25.82	29.65	33.18	37.53	40.65	43.65	47.48
2	0.9334	1.496	2.067	2.798	4.088	5.407	7.168	10.69	15.45	21.12	26.98	30.85	34.41	38.80	41.94	44.96	48.81
3	1.390	2.025	2.650	3.435	4.798	6.174	7.996	11.61	16.46	22.21	28.14	32.04	35.64	40.06	43.22	46.27	50.14
4	1.871	2.571	3.247	4.082	5.515	6.946	8.827	12.53	17.47	23.30	29.30	33.24	36.86	41.32	44.51	47.57	51.47
5	2.372	3.133	3.855	4.739	6.238	7.722	9.660	13.45	18.48	24.39	30.45	34.43	38.08	42.58	45.79	48.87	52.79
6	2.890	3.708	4.475	5.405	6.968	8.503	10.50	14.37	19.49	25.47	31.61	35.62	39.30	43.83	47.06	50.17	54.11
7	3.423	4.296	5.105	6.079	7.703	9.288	11.34	15.30	20.50	26.56	32.76	36.80	40.52	45.08	48.34	51.46	55.43
8	3.970	4.894	5.744	6.760	8.443	10.08	12.18	16.22	21.51	27.64	33.90	37.99	41.73	46.33	49.61	52.75	56.75
9	4.529	5.502	6.391	7.448	9.188	10.87	13.02	17.15	22.52	28.73	35.05	39.17	42.95	47.58	50.88	54.04	58.06
10	5.098	6.120	7.046	8.142	9.939	11.67	13.87	18.07	23.52	29.81	36.20	40.35	44.16	48.82	52.14	55.33	59.37
11	5.678	6.745	7.708	8.843	10.69	12.46	14.72	19.00	24.53	30.89	37.34	41.53	45.36	50.06	53.40	56.61	60.68
12	6.268	7.379	8.377	9.549	11.45	13.27	15.57	19.93	25.53	31.97	38.48	42.70	46.57	51.30	54.66	57.89	61.98
15	8.085	9.321	10.42	11.70	13.75	15.69	18.13	22.71	28.55	35.20	41.89	46.22	50.17	55.00	58.43	61.72	65.88
20	11.25	12.67	13.92	15.36	17.65	19.78	22.44	27.37	33.57	40.57	47.55	52.05	56.14	61.13	64.67	68.05	72.33

$\sqrt{\lambda} = 4.0$

1	0.8279	1.423	2.028	2.801	4.162	5.547	7.390	11.06	16.00	21.85	27.89	31.86	35.52	40.02	43.24	46.34	50.27
2	1.298	1.966	2.624	3.450	4.881	6.322	8.224	11.98	17.01	22.94	29.05	33.05	36.74	41.28	44.52	47.63	51.59
3	1.791	2.524	3.232	4.108	5.607	7.101	9.060	12.91	18.02	24.03	30.20	34.24	37.96	42.53	45.79	48.93	52.91
4	2.302	3.097	3.852	4.775	6.339	7.884	9.900	13.83	19.03	25.11	31.35	35.43	39.17	43.78	47.06	50.22	54.23
5	2.830	3.682	4.481	5.449	7.076	8.672	10.74	14.75	20.04	26.20	32.50	36.61	40.39	45.02	48.33	51.50	55.54
6	3.372	4.279	5.120	6.132	7.818	9.463	11.59	15.68	21.05	27.28	33.64	37.79	41.60	46.27	49.59	52.79	56.85
7	3.928	4.885	5.767	6.820	8.565	10.26	12.43	16.61	22.05	28.36	34.79	38.97	42.81	47.51	50.86	54.07	58.15
8	4.494	5.502	6.422	7.516	9.317	11.06	13.28	17.53	23.06	29.44	35.93	40.15	44.01	48.75	52.12	55.35	59.45
9	5.072	6.126	7.084	8.217	10.07	11.86	14.13	18.46	24.07	30.52	37.07	41.32	45.22	49.98	53.38	56.63	60.76
10	5.659	6.759	7.753	8.924	10.83	12.66	14.98	19.39	25.08	31.60	38.21	42.50	46.42	51.22	54.63	57.90	62.05
11	6.255	7.400	8.428	9.636	11.60	13.47	15.84	20.32	26.08	32.68	39.35	43.67	47.62	52.45	55.88	59.18	63.35
12	6.859	8.047	9.110	10.35	12.37	14.28	16.69	21.25	27.09	33.76	40.48	44.84	48.82	53.68	57.14	60.45	64.64
15	8.717	10.03	11.19	12.53	14.69	16.72	19.27	24.04	30.10	36.98	43.88	48.34	52.40	57.36	60.88	64.24	68.51
20	11.93	13.43	14.74	16.24	18.62	20.84	23.61	28.71	35.12	42.34	49.52	54.14	58.34	63.45	67.07	70.53	74.91

χ^2 0.999 0.9975 0.995 0.99 0.975 0.95 0.9 0.75 0.5 0.25 0.1 0.05 0.025 0.01 0.005 0.0025 0.001

$\sqrt{\lambda} = 4.2$

1	1.232	1.940	2.638	3.511	5.018	6.529	8.517	12.43	17.64	23.76	30.05	34.16	37.95	42.59	45.91	49.10	53.15
2	1.738	2.512	3.258	4.180	5.752	7.315	9.359	13.36	18.65	24.85	31.19	35.34	39.16	43.84	47.18	50.38	54.46
3	2.261	3.096	3.889	4.856	6.492	8.106	10.20	14.28	19.66	25.93	32.34	36.52	40.36	45.08	48.44	51.66	55.76
4	2.801	3.692	4.528	5.540	7.237	8.899	11.05	15.21	20.67	27.01	33.48	37.70	41.57	46.32	49.70	52.94	57.06
5	3.353	4.299	5.176	6.231	7.987	9.697	11.90	16.14	21.67	28.09	34.62	38.88	42.77	47.55	50.96	54.22	58.36
6	3.918	4.915	5.832	6.928	8.741	10.50	12.75	17.07	22.68	29.17	35.76	40.05	43.98	48.79	52.21	55.49	59.66
7	4.494	5.540	6.495	7.631	9.500	11.30	13.60	18.00	23.69	30.25	36.90	41.22	45.18	50.02	53.46	56.76	60.95
8	5.080	6.173	7.166	8.340	10.26	12.11	14.46	18.93	24.70	31.33	38.04	42.39	46.37	51.25	54.71	58.03	62.24
9	5.675	6.813	7.842	9.054	11.03	12.92	15.31	19.86	25.70	32.40	39.17	43.56	47.57	52.47	55.96	59.30	63.53
10	6.278	7.461	8.524	9.772	11.80	13.73	16.17	20.79	26.71	33.48	40.31	44.73	48.77	53.70	57.21	60.57	64.82
11	6.890	8.115	9.212	10.50	12.57	14.54	17.03	21.72	27.71	34.55	41.44	45.89	49.96	54.92	58.45	61.83	66.11
12	7.509	8.775	9.905	11.22	13.35	15.36	17.89	22.65	28.72	35.63	42.57	47.06	51.15	56.15	59.69	63.09	67.39
15	9.405	10.79	12.01	13.43	15.70	17.82	20.49	25.45	31.74	38.84	45.95	50.54	54.71	59.80	63.41	66.86	71.23
20	12.68	14.24	15.61	17.18	19.66	21.97	24.84	30.13	36.76	44.19	51.57	56.31	60.62	65.86	69.57	73.11	77.58

$\sqrt{\lambda} = 4.4$

1	1.716	2.538	3.328	4.300	5.954	7.591	9.725	13.88	19.36	25.75	32.28	36.54	40.45	45.24	48.66	51.94	56.11
2	2.253	3.135	3.969	4.987	6.702	8.388	10.57	14.81	20.37	26.83	33.42	37.71	41.65	46.48	49.92	53.21	57.40
3	2.804	3.742	4.620	5.681	7.455	9.188	11.42	15.74	21.38	27.91	34.56	38.89	42.85	47.71	51.17	54.49	58.69
4	3.368	4.359	5.278	6.380	8.212	9.992	12.28	16.67	22.38	28.99	35.70	40.06	44.05	48.94	52.42	55.75	59.99
5	3.943	4.985	5.943	7.086	8.973	10.80	13.13	17.60	23.39	30.07	36.83	41.22	45.24	50.16	53.67	57.02	61.27
6	4.529	5.619	6.615	7.797	9.739	11.61	13.99	18.53	24.40	31.14	37.97	42.39	46.44	51.39	54.91	58.28	62.56
7	5.124	6.261	7.293	8.513	10.51	12.42	14.85	19.46	25.40	32.22	39.10	43.56	47.63	52.61	56.15	59.55	63.84
8	5.727	6.910	7.977	9.234	11.28	13.23	15.71	20.40	26.41	33.29	40.23	44.72	48.82	53.83	57.40	60.80	65.12
9	6.339	7.565	8.667	9.959	12.06	14.05	16.57	21.33	27.42	34.37	41.36	45.88	50.01	55.05	58.64	62.06	66.40
10	6.958	8.227	9.362	10.69	12.83	14.87	17.44	22.26	28.42	35.44	42.49	47.04	51.20	56.27	59.87	63.32	67.68
11	7.585	8.894	10.06	11.42	13.62	15.69	18.30	23.20	29.43	36.51	43.62	48.20	52.39	57.49	61.11	64.57	68.96
12	8.218	9.567	10.77	12.16	14.40	16.51	19.17	24.13	30.43	37.58	44.74	49.36	53.57	58.70	62.34	65.82	70.23
15	10.15	11.61	12.90	14.40	16.77	19.00	21.78	26.94	33.45	40.79	48.11	52.83	57.11	62.33	66.04	69.57	74.04
20	13.48	15.11	16.54	18.18	20.77	23.17	26.15	31.63	38.47	46.13	53.71	58.58	62.99	68.36	72.16	75.78	80.36

χ^2 0.999 0.9975 0.995 0.99 0.975 0.95 0.9 0.75 0.5 0.25 0.1 0.05 0.025 0.01 0.0025 0.001

$\sqrt{\lambda} = 4.6$

1	2.276	3.215	4.097	5.170	6.970	8.733	11.01	15.41	21.16	27.82	34.59	39.00	43.03	47.97	51.49	54.86	59.14
2	2.844	3.834	4.758	5.873	7.730	9.540	11.87	16.34	22.17	28.90	35.73	40.16	44.23	49.20	52.74	56.13	60.43
3	3.420	4.462	5.426	6.581	8.495	10.35	12.73	17.27	23.17	29.97	36.86	41.33	45.42	50.42	53.98	57.39	61.71
4	4.006	5.098	6.101	7.295	9.263	11.16	13.59	18.21	24.18	31.05	37.99	42.49	46.61	51.64	55.22	58.65	62.99
5	4.602	5.742	6.782	8.014	10.04	11.98	14.45	19.14	25.19	32.12	39.12	43.66	47.80	52.86	56.46	59.90	64.27
6	5.207	6.393	7.468	8.738	10.81	12.79	15.31	20.07	26.19	33.20	40.25	44.82	48.99	54.08	57.69	61.16	65.54
7	5.820	7.050	8.161	9.466	11.59	13.61	16.17	21.01	27.20	34.27	41.38	45.98	50.17	55.29	58.93	62.41	66.82
8	6.440	7.714	8.858	10.20	12.37	14.43	17.04	21.94	28.21	35.34	42.50	47.13	51.35	56.51	60.16	63.66	68.09
9	7.068	8.383	9.560	10.93	13.15	15.26	17.91	22.88	29.21	36.41	43.63	48.29	52.54	57.72	61.39	64.91	69.36
10	7.702	9.058	10.27	11.67	13.94	16.08	18.78	23.82	30.22	37.48	44.75	49.44	53.72	58.93	62.62	66.16	70.63
11	8.342	9.738	10.98	12.42	14.73	16.91	19.65	24.75	31.22	38.55	45.88	50.60	54.90	60.14	63.85	67.40	71.89
12	8.988	10.42	11.69	13.17	15.52	17.74	20.52	25.69	32.23	39.62	47.00	51.75	56.08	61.34	65.08	68.65	73.16
15	10.96	12.50	13.86	15.43	17.92	20.24	23.14	28.50	35.24	42.82	50.36	55.20	59.60	64.96	68.75	72.37	76.94
20	14.33	16.05	17.54	19.25	21.95	24.45	27.53	33.20	40.26	48.14	55.94	60.93	65.45	70.95	74.83	78.54	83.22

$\sqrt{\lambda} = 4.8$

1	2.923	3.972	4.947	6.119	8.066	9.955	12.38	17.02	23.04	29.97	36.99	41.54	45.70	50.78	54.40	57.87	62.26
2	3.512	4.611	5.625	6.837	8.838	10.77	13.24	17.95	24.05	31.04	38.11	42.70	46.88	52.00	55.64	59.12	63.53
3	4.110	5.258	6.309	7.559	9.613	11.59	14.11	18.89	25.05	32.12	39.24	43.86	48.07	53.21	56.87	60.37	64.81
4	4.717	5.912	6.999	8.286	10.39	12.41	14.97	19.82	26.06	33.19	40.37	45.01	49.25	54.43	58.10	61.62	66.08
5	5.332	6.572	7.694	9.018	11.17	13.23	15.84	20.76	27.07	34.26	41.49	46.17	50.43	55.64	59.33	62.87	67.34
6	5.954	7.238	8.396	9.753	11.96	14.05	16.71	21.70	28.07	35.33	42.62	47.32	51.61	56.85	60.56	64.11	68.62
7	6.584	7.910	9.100	10.49	12.74	14.88	17.58	22.63	29.08	36.40	43.74	48.48	52.79	58.05	61.79	65.36	69.89
8	7.220	8.587	9.809	11.24	13.53	15.71	18.45	23.57	30.08	37.47	44.86	49.63	53.97	59.26	63.01	66.60	71.14
9	7.862	9.269	10.52	11.98	14.33	16.54	19.32	24.51	31.09	38.54	45.98	50.78	55.15	60.47	64.24	67.84	72.40
10	8.510	9.956	11.24	12.73	15.12	17.37	20.19	25.45	32.09	39.60	47.10	51.93	56.32	61.67	65.46	69.08	73.66
11	9.164	10.65	11.96	13.48	15.92	18.21	21.07	26.39	33.10	40.67	48.22	53.08	57.50	62.87	66.68	70.32	74.92
12	9.822	11.34	12.69	14.24	16.72	19.04	21.94	27.33	34.10	41.74	49.34	54.23	58.67	64.07	67.90	71.55	76.17
15	11.83	13.46	14.88	16.53	19.13	21.56	24.58	30.15	37.12	44.93	52.69	57.66	62.18	67.66	71.55	75.25	79.93
20	15.25	17.05	18.61	20.39	23.19	25.79	28.99	34.86	42.14	50.25	58.25	63.37	68.00	73.63	77.60	81.39	86.17

χ^2 0.999 0.9975 0.995 0.99 0.975 0.95 0.9 0.75 0.5 0.25 0.1 0.05 0.025 0.01 0.005 0.0025 0.001

$\sqrt{\lambda} = 5.0$

1	3.648	4.809	5.877	7.148	9.242	11.26	13.83	18.71	25.00	32.20	39.46	44.15	48.44	53.68	57.39	60.95	65.45
2	4.257	5.467	6.570	7.879	10.02	12.08	14.69	19.65	26.00	33.27	40.58	45.31	49.62	54.88	58.62	62.19	66.72
3	4.875	6.130	7.269	8.614	10.81	12.91	15.56	20.58	27.01	34.34	41.70	46.46	50.80	56.09	59.85	63.44	67.98
4	5.500	6.800	7.973	9.353	11.60	13.73	16.43	21.52	28.02	35.41	42.83	47.61	51.98	57.29	61.07	64.68	69.24
5	6.133	7.475	8.681	10.10	12.39	14.56	17.31	22.46	29.02	36.48	43.95	48.76	53.15	58.50	62.29	65.92	70.50
6	6.772	8.155	9.394	10.84	13.18	15.39	18.18	23.40	30.03	37.55	45.07	49.91	54.32	59.70	63.51	67.15	71.76
7	7.417	8.840	10.11	11.59	13.98	16.23	19.05	24.34	31.03	38.61	46.19	51.06	55.50	60.90	64.73	68.39	73.02
8	8.067	9.531	10.83	12.34	14.77	17.06	19.93	25.28	32.04	39.68	47.30	52.21	56.67	62.10	65.95	69.62	74.27
9	8.724	10.23	11.56	13.10	15.57	17.90	20.81	26.22	33.05	40.74	48.42	53.35	57.84	63.30	67.17	70.86	75.52
10	9.385	10.92	12.28	13.86	16.38	18.74	21.68	27.16	34.05	41.81	49.54	54.50	59.01	64.50	68.38	72.09	76.77
11	10.05	11.63	13.02	14.62	17.18	19.58	22.56	28.10	35.05	42.88	50.65	55.64	60.18	65.69	69.59	73.32	78.02
12	10.72	12.33	13.75	15.39	17.99	20.42	23.44	29.04	36.06	43.94	51.76	56.78	61.34	66.89	70.81	74.55	79.27
15	12.76	14.47	15.97	17.70	20.42	22.95	26.09	31.87	39.07	47.13	55.10	60.21	64.84	70.46	74.44	78.23	83.01
20	16.23	18.11	19.74	21.59	24.51	27.20	30.52	36.58	44.09	52.43	60.65	65.89	70.64	76.40	80.46	84.33	89.21

$\sqrt{\lambda} = 5.2$

1	4.451	5.726	6.886	8.258	10.50	12.64	15.35	20.48	27.04	34.51	42.01	46.85	51.27	56.65	60.46	64.11	68.73
2	5.080	6.400	7.594	9.001	11.29	13.47	16.23	21.42	28.04	35.58	43.13	48.00	52.44	57.85	61.68	65.35	69.99
3	5.716	7.079	8.306	9.747	12.08	14.30	17.10	22.36	29.05	36.64	44.25	49.15	53.61	59.05	62.90	66.58	71.24
4	6.359	7.763	9.023	10.50	12.88	15.14	17.98	23.30	30.06	37.71	45.37	50.29	54.78	60.24	64.12	67.82	72.49
5	7.007	8.452	9.743	11.25	13.68	15.97	18.85	24.24	31.06	38.78	46.48	51.44	55.95	61.44	65.33	69.05	73.74
6	7.661	9.145	10.47	12.01	14.48	16.81	19.73	25.18	32.07	39.84	47.60	52.58	57.12	62.64	66.54	70.28	74.99
7	8.320	9.843	11.20	12.77	15.28	17.65	20.61	26.12	33.07	40.91	48.71	53.73	58.29	63.83	67.76	71.50	76.24
8	8.985	10.55	11.93	13.53	16.09	18.49	21.49	27.06	34.08	41.97	49.83	54.87	59.45	65.02	68.97	72.73	77.49
9	9.654	11.25	12.66	14.29	16.90	19.33	22.37	28.00	35.08	43.04	50.94	56.01	60.62	66.22	70.18	73.96	78.73
10	10.33	11.96	13.40	15.06	17.71	20.18	23.25	28.95	36.09	44.10	52.05	57.15	61.78	67.41	71.39	75.18	79.98
11	11.01	12.67	14.14	15.83	18.52	21.02	24.14	29.89	37.09	45.16	53.16	58.29	62.94	68.60	72.59	76.41	81.22
12	11.69	13.39	14.89	16.60	19.33	21.87	25.02	30.83	38.10	46.22	54.27	59.43	64.10	69.78	73.80	77.63	82.46
15	13.76	15.56	17.13	18.94	21.78	24.42	27.68	33.66	41.11	49.41	57.60	62.84	67.58	73.34	77.41	81.29	86.18
20	17.28	19.23	20.93	22.87	25.90	28.69	32.13	38.39	46.13	54.70	63.13	68.50	73.36	79.25	83.40	87.36	92.34

λ 0.999 0.9975 0.995 0.99 0.975 0.95 0.9 0.75 0.5 0.25 0.1 0.05 0.025 0.01 0.005 0.0025 0.001

$\sqrt{\lambda} = 5.4$

1	5.335	6.724	7.976	9.447	11.83	14.10	16.96	22.33	29.16	36.90	44.64	49.63	54.17	59.70	62.61	67.36	72.09
2	5.982	7.412	8.697	10.20	12.63	14.94	17.84	23.27	30.16	37.96	45.76	50.77	55.34	60.89	64.83	68.58	73.34
3	6.634	8.105	9.421	10.96	13.44	15.78	18.72	24.21	31.17	39.03	46.87	51.92	56.50	62.08	66.04	69.81	74.58
4	7.292	8.802	10.15	11.72	14.24	16.62	19.60	25.16	32.18	40.09	47.99	53.06	57.67	63.27	67.25	71.04	75.83
5	7.955	9.504	10.88	12.48	15.05	17.46	20.48	26.10	33.18	41.16	49.00	54.20	58.83	64.47	68.45	72.26	77.07
6	8.623	10.21	11.62	13.25	15.86	18.30	21.36	27.04	34.18	42.22	50.28	55.34	59.99	65.65	69.66	73.48	78.31
7	9.296	10.92	12.35	14.02	16.67	19.15	22.25	27.98	35.19	43.28	51.32	56.48	61.16	66.84	70.87	74.70	79.55
8	9.973	11.63	13.10	14.79	17.48	19.99	23.13	28.93	36.20	44.35	52.43	57.61	62.32	68.03	72.07	75.92	80.79
9	10.65	12.35	13.84	15.56	18.29	20.84	24.01	29.87	37.20	45.40	53.54	58.75	63.48	69.22	73.27	77.14	82.03
10	11.34	13.07	14.59	16.34	19.11	21.69	24.90	30.81	38.20	46.47	54.65	59.89	64.64	70.40	74.48	78.36	83.26
11	12.03	13.79	15.34	17.11	19.93	22.54	25.79	31.76	39.21	47.53	55.76	61.02	65.79	71.58	75.68	79.58	84.50
12	12.72	14.52	16.09	17.89	20.75	23.39	26.67	32.70	40.21	48.59	56.86	62.15	66.95	72.77	76.88	80.79	85.73
15	14.82	16.72	18.36	20.25	23.21	25.96	29.34	35.54	43.22	51.76	60.18	65.55	70.41	76.31	80.47	84.43	89.43
20	18.38	20.43	22.20	24.21	27.36	30.25	33.81	40.27	48.24	57.05	65.70	71.20	76.17	82.19	86.44	90.48	95.57

$\sqrt{\lambda} = 5.6$

1	6.299	7.801	9.146	10.72	13.25	15.64	18.65	24.26	31.36	39.37	47.36	52.49	57.15	62.83	66.84	70.68	75.52
2	6.961	8.503	9.878	11.48	14.06	16.49	19.53	25.20	32.36	40.43	48.47	53.63	58.31	64.01	68.05	71.90	76.76
3	7.629	9.208	10.61	12.25	14.87	17.33	20.41	26.15	33.37	41.49	49.58	54.76	59.48	65.20	69.25	73.12	78.00
4	8.301	9.918	11.35	13.02	15.68	18.18	21.30	27.09	34.37	42.56	50.69	55.90	60.63	66.39	70.46	74.34	79.24
5	8.978	10.63	12.09	13.79	16.49	19.03	22.18	28.04	35.38	43.62	51.80	57.04	61.79	67.57	71.66	75.55	80.47
6	9.659	11.35	12.84	14.56	17.31	19.87	23.07	28.98	36.38	44.68	52.90	58.17	62.95	68.75	72.86	76.77	81.71
7	10.34	12.07	13.59	15.34	18.13	20.72	23.96	29.92	37.39	45.74	54.01	59.31	64.11	69.94	74.06	77.98	82.94
8	11.03	12.79	14.34	16.12	18.94	21.58	24.85	30.87	38.39	46.80	55.12	60.44	65.26	71.12	75.26	79.20	84.17
9	11.73	13.52	15.09	16.90	19.76	22.43	25.73	31.82	39.40	47.86	56.22	61.57	66.42	72.30	76.45	80.41	85.40
10	12.42	14.25	15.85	17.68	20.59	23.28	26.62	32.76	40.40	48.92	57.33	62.70	67.57	73.48	77.65	81.62	86.63
11	13.12	14.98	16.61	18.47	21.41	24.14	27.51	33.71	41.41	49.97	58.43	63.83	68.73	74.66	78.84	82.83	87.86
12	13.83	15.72	17.37	19.26	22.24	25.00	28.41	34.65	42.41	51.04	59.54	64.96	69.88	75.83	80.04	84.04	89.09
15	15.95	17.94	19.66	21.63	24.72	27.57	31.08	37.50	45.42	54.21	62.84	68.35	73.33	79.36	83.61	87.66	92.77
20	19.56	21.69	23.53	25.62	28.89	31.89	35.56	42.24	50.44	59.48	68.34	73.98	79.07	85.22	89.55	93.68	98.87

\sqrt{Q} 0.999 0.9975 0.995 0.99 0.975 0.95 0.9 0.75 0.5 0.25 0.1 0.05 0.025 0.01 0.005 0.0025 0.001

$\sqrt{\lambda} = 5.8$

1	7.343	8.958	10.40	12.07	14.75	17.27	20.42	26.27	33.64	41.92	50.15	55.43	60.22	66.04	70.15	74.08	79.04
2	8.020	9.672	11.14	12.84	15.56	18.11	21.30	27.22	34.64	42.98	51.26	56.56	61.37	67.22	71.35	75.30	80.27
3	8.701	10.39	11.88	13.62	16.38	18.96	22.19	28.16	35.65	44.04	52.36	57.69	62.53	68.40	72.55	76.51	81.50
4	9.386	11.11	12.63	14.39	17.20	19.82	23.08	29.11	36.65	45.10	53.47	58.83	63.68	69.58	73.75	77.72	82.73
5	10.08	11.84	13.39	15.17	18.02	20.67	23.97	30.05	37.66	46.16	54.57	59.96	64.84	70.76	74.94	78.93	83.96
6	10.77	12.56	14.14	15.96	18.84	21.52	24.86	31.00	38.66	47.22	55.68	61.09	65.99	71.94	76.14	80.14	85.19
7	11.47	13.29	14.90	16.74	19.66	22.38	25.75	31.95	39.66	48.28	56.78	62.22	67.14	73.11	77.33	81.35	86.41
8	12.17	14.03	15.66	17.53	20.49	23.24	26.64	32.89	40.67	49.34	57.88	63.35	68.29	74.29	78.52	82.56	87.64
9	12.87	14.76	16.42	18.32	21.31	24.09	27.53	33.84	41.67	50.39	58.99	64.48	69.44	75.46	79.71	83.76	88.86
10	13.58	15.50	17.18	19.11	22.14	24.95	28.43	34.79	42.68	51.45	60.09	65.60	70.59	76.64	80.90	84.97	90.09
11	14.29	16.24	17.95	19.90	22.97	25.81	29.32	35.73	43.68	52.51	61.19	66.73	71.74	77.81	82.09	86.17	91.31
12	15.00	16.99	18.72	20.69	23.80	26.67	30.22	36.68	44.69	53.56	62.29	67.86	72.89	78.98	83.28	87.38	92.53
15	17.16	19.23	21.03	23.09	26.30	29.26	32.90	39.52	47.69	56.73	65.59	71.23	76.33	82.50	86.84	90.98	96.19
20	20.80	23.02	24.94	27.11	30.49	33.60	37.40	44.27	52.71	62.00	71.08	76.84	82.05	88.33	92.76	96.97	102.3

$\sqrt{\lambda} = 6.0$

1	8.466	10.20	11.73	13.50	16.32	18.97	22.26	28.36	36.00	44.55	53.02	58.44	63.36	69.33	73.55	77.56	82.63
2	9.157	10.92	12.48	14.28	17.14	19.82	23.15	29.31	37.00	45.61	54.12	59.57	64.51	70.50	74.74	78.77	83.86
3	9.851	11.65	13.23	15.06	17.97	20.68	24.05	30.25	38.01	46.67	55.23	60.70	65.66	71.68	75.93	79.98	85.08
4	10.55	12.38	13.99	15.85	18.79	21.53	24.94	31.20	39.01	47.72	56.33	61.83	66.81	72.85	77.12	81.18	86.31
5	11.25	13.12	14.75	16.64	19.62	22.39	25.83	32.15	40.02	48.78	57.43	62.96	67.96	74.03	78.31	82.39	87.53
6	11.95	13.85	15.52	17.43	20.45	23.25	26.72	33.10	41.02	49.84	58.53	64.09	69.11	75.20	79.50	83.59	88.75
7	12.66	14.59	16.28	18.22	21.28	24.11	27.62	34.05	42.02	50.90	59.63	65.21	70.26	76.37	80.69	84.79	89.97
8	13.37	15.34	17.05	19.01	22.11	24.97	28.51	34.99	43.03	51.95	60.73	66.34	71.41	77.54	81.87	86.00	91.19
9	14.09	16.08	17.82	19.81	22.94	25.83	29.41	35.94	44.03	53.01	61.83	67.46	72.55	78.71	83.06	87.20	92.41
10	14.80	16.83	18.59	20.60	23.77	26.70	30.30	36.89	45.03	54.06	62.93	68.59	73.70	79.88	84.24	88.40	93.63
11	15.52	17.58	19.36	21.40	24.61	27.56	31.20	37.84	46.04	55.11	64.03	69.71	74.84	81.05	85.43	89.59	94.84
12	16.24	18.33	20.14	22.20	25.44	28.43	32.10	38.79	47.04	56.17	65.13	70.83	75.98	82.22	86.61	90.79	96.06
15	18.43	20.60	22.48	24.61	27.96	31.03	34.80	41.64	50.05	59.33	68.43	74.20	79.41	85.72	90.16	94.38	99.70
20	22.11	24.42	26.41	28.66	32.18	35.38	39.30	46.40	55.07	64.60	73.89	79.79	85.11	91.53	96.05	100.3	105.7