

TABLES OF K VALUES

The following table¹ contains K values for use in equation (1), for skew coefficients, G, from 0 to 9.0 and 0 to -9.0 and exceedance probabilities, P, from 0.9999 to 0.0001.

Approximate values of K can be obtained from the following transformation (26) when skew coefficients are between 1.0 and -1.0:

$$K = \frac{2}{G} \left[\left[\left(K_n - \frac{G}{6} \right) \frac{G}{6} + 1 \right]^3 - 1 \right] \quad (3-1)$$

where K_n is the standard normal deviate and G is the skew coefficient. Because of the limitations (27) involved in use of this and other transforms, use of the table is preferred.

¹This table was computed by Dr. H. Leon Harter and published in Technometrics, Vol. 11, No. 1, Feb. 1969, pp. 177-187, and Vol. 13, No. 1, Feb. 1971, pp. 203-204, "A New Table of Percentage Points of the Pearson Type III Distribution" and "More Percentage Points of the Pearson Distribution," respectively. These publications describe values only for positive coefficient of skew. Values for negative coefficient of skew were obtained by inverting the positive table and changing signs. The latter work was performed by the Central Technical Unit, SCS, Hyattsville, Md.

P	G =0.0	G =0.1	G =0.2	G =0.3	G =0.4	G =0.5	G =0.6
0.9999	-3.71902	-3.50703	-3.29921	-3.09631	-2.89907	-2.70836	-2.52507
0.9995	-3.29053	-3.12767	-2.96698	-2.80889	-2.65390	-2.50257	-2.35549
0.9990	-3.09023	-2.94834	-2.80786	-2.66915	-2.53261	-2.39867	-2.26780
0.9980	-2.87816	-2.75706	-2.63672	-2.51741	-2.39942	-2.28311	-2.16884
0.9950	-2.57583	-2.48187	-2.38795	-2.29423	-2.20092	-2.10825	-2.01644
0.9900	-2.32635	-2.25258	-2.17840	-2.10394	-2.02933	-1.95472	-1.88029
0.9800	-2.05375	-1.99973	-1.94499	-1.88959	-1.83361	-1.77716	-1.72033
0.9750	-1.95996	-1.91219	-1.86360	-1.81427	-1.76427	-1.71366	-1.66253
0.9600	-1.75069	-1.71580	-1.67999	-1.64329	-1.60574	-1.56740	-1.52830
0.9500	-1.64485	-1.61594	-1.58607	-1.55527	-1.52357	-1.49101	-1.45762
0.9000	-1.28155	-1.27037	-1.25824	-1.24516	-1.23114	-1.21618	-1.20028
0.8000	-0.84162	-0.84611	-0.84986	-0.85285	-0.85508	-0.85653	-0.85718
0.7000	-0.52440	-0.53624	-0.54757	-0.55839	-0.56867	-0.57840	-0.58757
0.6000	-0.25335	-0.26882	-0.28403	-0.29897	-0.31362	-0.32796	-0.34198
0.5704	-0.17733	-0.19339	-0.20925	-0.22492	-0.24037	-0.25558	-0.27047
0.5000	0.0	-0.01662	-0.03325	-0.04993	-0.06651	-0.08302	-0.09945
0.4296	0.17733	0.16111	0.14472	0.12820	0.11154	0.09478	0.07791
0.4000	0.25335	0.23763	0.22168	0.20552	0.18916	0.17261	0.15589
0.3000	0.52440	0.51207	0.49927	0.48600	0.47228	0.45812	0.44352
0.2000	0.84162	0.83639	0.83044	0.82377	0.81638	0.80829	0.79950
0.1000	1.28155	1.29178	1.30105	1.30936	1.31671	1.32309	1.32850
0.0500	1.64485	1.67279	1.69971	1.72562	1.75048	1.77428	1.79701
0.0400	1.75069	1.78462	1.81756	1.84949	1.88039	1.91022	1.93896
0.0250	1.95996	2.00688	2.05290	2.09795	2.14202	2.18505	2.22702
0.0200	2.05375	2.10697	2.15935	2.21081	2.26133	2.31084	2.35931
0.0100	2.32635	2.39961	2.47226	2.54421	2.61539	2.68572	2.75514
0.0050	2.57583	2.66965	2.76321	2.85636	2.94900	3.04102	3.13232
0.0020	2.87816	2.99978	3.12169	3.24371	3.36566	3.48737	3.60872
0.0010	3.09023	3.23322	3.37703	3.52139	3.66608	3.81090	3.95567
0.0005	3.29053	3.45513	3.62113	3.78820	3.95605	4.12443	4.29311
0.0001	3.71902	3.93453	4.15301	4.37394	4.59687	4.82141	5.04718

P	G = 0.7	G = 0.8	G = 0.9	G = 1.0	G = 1.1	G = 1.2	G = 1.3
0.9999	-2.35015	-2.18448	-2.02891	-1.88410	-1.75053	-1.62838	-1.51752
0.9995	-2.21328	-2.07661	-1.94611	-1.82241	-1.70603	-1.59738	-1.49673
0.9990	-2.14053	-2.01739	-1.89894	-1.78572	-1.67825	-1.57695	-1.48216
0.9980	-2.05701	-1.94806	-1.84244	-1.74062	-1.64305	-1.55016	-1.46232
0.9950	-1.92580	-1.83660	-1.74919	-1.66390	-1.58110	-1.50114	-1.42439
0.9900	-1.80621	-1.73271	-1.66001	-1.58838	-1.51808	-1.44942	-1.38267
0.9800	-1.66325	-1.60604	-1.54886	-1.49188	-1.43529	-1.37929	-1.32412
0.9750	-1.61099	-1.55914	-1.50712	-1.45507	-1.40314	-1.35153	-1.30042
0.9600	-1.48852	-1.44813	-1.40720	-1.36584	-1.32414	-1.28225	-1.24028
0.9500	-1.42345	-1.38855	-1.35299	-1.31684	-1.28019	-1.24313	-1.20578
0.9000	-1.18347	-1.16574	-1.14712	-1.12762	-1.10726	-1.08608	-1.06413
0.8000	-0.85703	-0.85607	-0.85426	-0.85161	-0.84809	-0.84369	-0.83841
0.7000	-0.59615	-0.60412	-0.61146	-0.61815	-0.62415	-0.62944	-0.63400
0.6000	-0.35565	-0.36889	-0.38186	-0.39434	-0.40638	-0.41794	-0.42899
0.5704	-0.28516	-0.29961	-0.31368	-0.32740	-0.34075	-0.35370	-0.36620
0.5000	-0.11578	-0.13199	-0.14807	-0.16397	-0.17968	-0.19517	-0.21040
0.4296	0.06097	0.04397	0.02693	0.00987	-0.00719	-0.02421	-0.04116
0.4000	0.13901	0.12199	0.10486	0.08763	0.07032	0.05297	0.03560
0.3000	0.42851	0.41309	0.39729	0.38111	0.36458	0.34772	0.33054
0.2000	0.79002	0.77986	0.76902	0.75752	0.74537	0.73257	0.71915
0.1000	1.33294	1.33640	1.33889	1.34039	1.34092	1.34047	1.33904
0.0500	1.81864	1.83916	1.85856	1.87683	1.89395	1.90992	1.92472
0.0400	1.96660	1.99311	2.01848	2.04269	2.06573	2.08758	2.10823
0.0250	2.26790	2.30764	2.34623	2.38364	2.41984	2.45482	2.48855
0.0200	2.40670	2.45298	2.49811	2.54206	2.58480	2.62631	2.66657
0.0100	2.82359	2.89101	2.95735	3.02256	3.08660	3.14944	3.21103
0.0050	3.22281	3.31243	3.40109	3.48874	3.57530	3.66073	3.74497
0.0020	3.72957	3.84981	3.96932	4.08802	4.20582	4.32263	4.43839
0.0010	4.10022	4.24439	4.38807	4.53112	4.67344	4.81492	4.95549
0.0005	4.46189	4.63057	4.79899	4.96701	5.13449	5.30130	5.46735
0.0001	5.27389	5.50124	5.72899	5.95691	6.18480	6.41249	6.63980

P	G =1.4	G =1.5	G =1.6	G =1.7	G =1.8	G =1.9	G =2.0
0.9999	-1.41753	-1.32774	-1.24728	-1.17520	-1.11054	-1.05239	-0.99990
0.9995	-1.40413	-1.31944	-1.24235	-1.17240	-1.10901	-1.05159	-0.99950
0.9990	-1.39408	-1.31275	-1.23805	-1.16974	-1.10743	-1.05068	-0.99900
0.9980	-1.37981	-1.30279	-1.23132	-1.16534	-1.10465	-1.04898	-0.99800
0.9950	-1.35114	-1.28167	-1.21618	-1.15477	-1.09749	-1.04427	-0.99499
0.9900	-1.31815	-1.25611	-1.19680	-1.14042	-1.08711	-1.03695	-0.98995
0.9800	-1.26999	-1.21716	-1.16584	-1.11628	-1.06864	-1.02311	-0.97980
0.9750	-1.25004	-1.20059	-1.15229	-1.10537	-1.06001	-1.01640	-0.97468
0.9600	-1.19842	-1.15682	-1.11566	-1.07513	-1.03543	-0.99672	-0.95918
0.9500	-1.16827	-1.13075	-1.09338	-1.05631	-1.01973	-0.98381	-0.94871
0.9000	-1.04144	-1.01810	-0.99418	-0.96977	-0.94496	-0.91988	-0.89464
0.8000	-0.83223	-0.82516	-0.81720	-0.80837	-0.79868	-0.78816	-0.77686
0.7000	-0.63779	-0.64080	-0.64300	-0.64436	-0.64488	-0.64453	-0.64333
0.6000	-0.43949	-0.44942	-0.45873	-0.46739	-0.47538	-0.48265	-0.48917
0.5704	-0.37824	-0.38977	-0.40075	-0.41116	-0.42095	-0.43008	-0.43854
0.5000	-0.22535	-0.23996	-0.25422	-0.26808	-0.28150	-0.29443	-0.30685
0.4296	-0.05803	-0.07476	-0.09132	-0.10769	-0.12381	-0.13964	-0.15516
0.4000	0.01824	0.00092	-0.01631	-0.03344	-0.05040	-0.06718	-0.08371
0.3000	0.31307	0.29535	0.27740	0.25925	0.24094	0.22250	0.20397
0.2000	0.70512	0.69050	0.67532	0.65959	0.64335	0.62662	0.60944
0.1000	1.33665	1.33330	1.32900	1.32376	1.31760	1.31054	1.30259
0.0500	1.93836	1.95083	1.96213	1.97227	1.98124	1.98906	1.99573
0.0400	2.12768	2.14591	2.16293	2.17873	2.19332	2.20670	2.21888
0.0250	2.52102	2.55222	2.58214	2.61076	2.63810	2.66413	2.68888
0.0200	2.70556	2.74325	2.77964	2.81472	2.84848	2.88091	2.91202
0.0100	3.27134	3.33035	3.38804	3.44438	3.49935	3.55295	3.60517
0.0050	3.82798	3.90973	3.99016	4.06926	4.14700	4.22336	4.29832
0.0020	4.55304	4.66651	4.77875	4.88971	4.99937	5.10768	5.21461
0.0010	5.09505	5.23353	5.37087	5.50701	5.64190	5.77549	5.90776
0.0005	5.63252	5.79673	5.95990	6.12196	6.28285	6.44251	6.60090
0.0001	6.86661	7.09277	7.31818	7.54272	7.76632	7.98888	8.21034

P	G =2.1	G =2.2	G =2.3	G =2.4	G =2.5	G =2.6	G =2.7
0.9999	-0.95234	-0.90908	-0.86956	-0.83333	-0.80000	-0.76923	-0.74074
0.9995	-0.95215	-0.90899	-0.86952	-0.83331	-0.79999	-0.76923	-0.74074
0.9990	-0.95188	-0.90885	-0.86945	-0.83328	-0.79998	-0.76922	-0.74074
0.9980	-0.95131	-0.90854	-0.86929	-0.83320	-0.79994	-0.76920	-0.74073
0.9950	-0.94945	-0.90742	-0.86863	-0.83283	-0.79973	-0.76909	-0.74067
0.9900	-0.94607	-0.90521	-0.86723	-0.83196	-0.79921	-0.76878	-0.74049
0.9800	-0.93878	-0.90009	-0.86371	-0.82959	-0.79765	-0.76779	-0.73987
0.9750	-0.93495	-0.89728	-0.86169	-0.82817	-0.79667	-0.76712	-0.73943
0.9600	-0.92295	-0.88814	-0.85486	-0.82315	-0.79306	-0.76456	-0.73765
0.9500	-0.91458	-0.88156	-0.84976	-0.81927	-0.79015	-0.76242	-0.73610
0.9000	-0.86938	-0.84422	-0.81929	-0.79472	-0.77062	-0.74709	-0.72422
0.8000	-0.76482	-0.75211	-0.73880	-0.72495	-0.71067	-0.69602	-0.68111
0.7000	-0.64125	-0.63833	-0.63456	-0.62999	-0.62463	-0.61854	-0.61176
0.6000	-0.49494	-0.49991	-0.50409	-0.50744	-0.50999	-0.51171	-0.51263
0.5704	-0.44628	-0.45329	-0.45953	-0.46499	-0.46966	-0.47353	-0.47660
0.5000	-0.31872	-0.32999	-0.34063	-0.35062	-0.35992	-0.36852	-0.37640
0.4296	-0.17030	-0.18504	-0.19933	-0.21313	-0.22642	-0.23915	-0.25129
0.4000	-0.09997	-0.11590	-0.13148	-0.14665	-0.16138	-0.17564	-0.18939
0.3000	0.18540	0.16682	0.14827	0.12979	0.11143	0.09323	0.07523
0.2000	0.59183	0.57383	0.55549	0.53683	0.51789	0.49872	0.47934
0.1000	1.29377	1.28412	1.27365	1.26240	1.25039	1.23766	1.22422
0.0500	2.00128	2.00570	2.00903	2.01128	2.01247	2.01263	2.01177
0.0400	2.22986	2.23967	2.24831	2.25581	2.26217	2.26743	2.27160
0.0250	2.71234	2.73451	2.75541	2.77506	2.79345	2.81062	2.82658
0.0200	2.94181	2.97028	2.99744	3.02330	3.04787	3.07116	3.09320
0.0100	3.65600	3.70543	3.75347	3.80013	3.84540	3.88930	3.93183
0.0050	4.37186	4.44398	4.51467	4.58393	4.65176	4.71815	4.78313
0.0020	5.32014	5.42426	5.52694	5.62818	5.72796	5.82629	5.92316
0.0010	6.03865	6.16816	6.29626	6.42292	6.54814	6.67191	6.79421
0.0005	6.75798	6.91370	7.06804	7.22098	7.37250	7.52258	7.67121
0.0001	8.43064	8.64971	8.86753	9.08403	9.29920	9.51301	9.72543

P	G =2.8	G =2.9	G =3.0	G =3.1	G =3.2	G =3.3	G =3.4
0.9999	-0.71429	-0.68966	-0.66667	-0.64516	-0.62500	-0.60606	-0.58824
0.9995	-0.71429	-0.68966	-0.66667	-0.64516	-0.62500	-0.60606	-0.58824
0.9990	-0.71428	-0.68965	-0.66667	-0.64516	-0.62500	-0.60606	-0.58824
0.9980	-0.71428	-0.68965	-0.66667	-0.64516	-0.62500	-0.60606	-0.58824
0.9950	-0.71425	-0.68964	-0.66666	-0.64516	-0.62500	-0.60606	-0.58824
0.9900	-0.71415	-0.68959	-0.66663	-0.64514	-0.62499	-0.60606	-0.58823
0.9800	-0.71377	-0.68935	-0.66649	-0.64507	-0.62495	-0.60603	-0.58822
0.9750	-0.71348	-0.68917	-0.66638	-0.64500	-0.62491	-0.60601	-0.58821
0.9600	-0.71227	-0.68836	-0.66585	-0.64465	-0.62469	-0.60587	-0.58812
0.9500	-0.71116	-0.68759	-0.66532	-0.64429	-0.62445	-0.60572	-0.58802
0.9000	-0.70209	-0.68075	-0.66023	-0.64056	-0.62175	-0.60379	-0.58666
0.8000	-0.66603	-0.65086	-0.63569	-0.62060	-0.60567	-0.59096	-0.57652
0.7000	-0.60434	-0.59634	-0.58783	-0.57887	-0.56953	-0.55989	-0.55000
0.6000	-0.51276	-0.51212	-0.51073	-0.50863	-0.50585	-0.50244	-0.49844
0.5704	-0.47888	-0.48037	-0.48109	-0.48107	-0.48033	-0.47890	-0.47682
0.5000	-0.38353	-0.38991	-0.39554	-0.40041	-0.40454	-0.40792	-0.41058
0.4296	-0.26282	-0.27372	-0.28395	-0.29351	-0.30238	-0.31055	-0.31802
0.4000	-0.20259	-0.21523	-0.22726	-0.23868	-0.24946	-0.25958	-0.26904
0.3000	0.05746	0.03997	0.02279	0.00596	-0.01050	-0.02654	-0.04215
0.2000	0.45980	0.44015	0.42040	0.40061	0.38081	0.36104	0.34133
0.1000	1.21013	1.19539	1.18006	1.16416	1.14772	1.13078	1.11337
0.0500	2.00992	2.00710	2.00335	1.99869	1.99314	1.98674	1.97951
0.0400	2.27470	2.27676	2.27780	2.27785	2.27693	2.27506	2.27229
0.0250	2.84134	2.85492	2.86735	2.87865	2.88884	2.89795	2.90599
0.0200	3.11399	3.13356	3.15193	3.16911	3.18512	3.20000	3.21375
0.0100	3.97301	4.01286	4.05138	4.08859	4.12452	4.15917	4.19257
0.0050	4.84669	4.90884	4.96959	5.02897	5.08697	5.14362	5.19892
0.0020	6.01858	6.11254	6.20506	6.29613	6.38578	6.47401	6.56084
0.0010	6.91505	7.03443	7.15235	7.26881	7.38382	7.49739	7.60953
0.0005	7.81839	7.96411	8.10836	8.25115	8.39248	8.53236	8.67079
0.0001	9.93643	10.14602	10.35418	10.56090	10.76618	10.97001	11.17239

P	G =3.5	G =3.6	G =3.7	G =3.8	G =3.9	G =4.0	G =4.1
0.9999	-0.57143	-0.55556	-0.54054	-0.52632	-0.51282	-0.50000	-0.48780
0.9995	-0.57143	-0.55556	-0.54054	-0.52632	-0.51282	-0.50000	-0.48780
0.9990	-0.57143	-0.55556	-0.54054	-0.52632	-0.51282	-0.50000	-0.48780
0.9980	-0.57143	-0.55556	-0.54054	-0.52632	-0.51282	-0.50000	-0.48780
0.9950	-0.57143	-0.55556	-0.54054	-0.52632	-0.51282	-0.50000	-0.48780
0.9900	-0.57143	-0.55556	-0.54054	-0.52632	-0.51282	-0.50000	-0.48780
0.9800	-0.57142	-0.55555	-0.54054	-0.52631	-0.51282	-0.50000	-0.48780
0.9750	-0.57141	-0.55555	-0.54054	-0.52631	-0.51282	-0.50000	-0.48780
0.9600	-0.57136	-0.55552	-0.54052	-0.52630	-0.51281	-0.50000	-0.48780
0.9500	-0.57130	-0.55548	-0.54050	-0.52629	-0.51281	-0.49999	-0.48780
0.9000	-0.57035	-0.55483	-0.54006	-0.52600	-0.51261	-0.49986	-0.48772
0.8000	-0.56242	-0.54867	-0.53533	-0.52240	-0.50990	-0.49784	-0.48622
0.7000	-0.53993	-0.52975	-0.51952	-0.50929	-0.49911	-0.48902	-0.47906
0.6000	-0.49391	-0.48888	-0.48342	-0.47758	-0.47141	-0.46496	-0.45828
0.5704	-0.47413	-0.47088	-0.46711	-0.46286	-0.45819	-0.45314	-0.44777
0.5000	-0.41253	-0.41381	-0.41442	-0.41441	-0.41381	-0.41265	-0.41097
0.4296	-0.32479	-0.33085	-0.33623	-0.34092	-0.34494	-0.34831	-0.35105
0.4000	-0.27782	-0.28592	-0.29335	-0.30010	-0.30617	-0.31159	-0.31635
0.3000	-0.05730	-0.07195	-0.08610	-0.09972	-0.11279	-0.12530	-0.13725
0.2000	0.32171	0.30223	0.28290	0.26376	0.24484	0.22617	0.20777
0.1000	1.09552	1.07726	1.05863	1.03965	1.02036	1.00079	0.98096
0.0500	1.97147	1.95266	1.93311	1.94283	1.93186	1.92023	1.90796
0.0400	2.26862	2.26409	2.25872	2.25254	2.24558	2.23786	2.22940
0.0250	2.91294	2.91898	2.92397	2.92799	2.93107	2.93324	2.93450
0.0200	3.22641	3.23800	3.24853	3.25803	3.26653	3.27404	3.28060
0.0100	4.22473	4.25569	4.28545	4.31403	4.34147	4.36777	4.39296
0.0050	5.25291	5.30559	5.35698	5.40711	5.45598	5.50362	5.55005
0.0020	6.64627	6.73032	6.81301	6.89435	6.97435	7.05304	7.13043
0.0010	7.72024	7.82954	7.93744	8.04395	8.14910	8.25289	8.35534
0.0005	8.80779	8.94335	9.07750	9.21023	9.34158	9.47154	9.60013
0.0001	11.37334	11.57284	11.77092	11.96757	12.16280	12.35663	12.54906

P	G =4.2	G =4.3	G =4.4	G =4.5	G =4.6	G =4.7	G =4.8
0.9999	-0.47619	-0.46512	-0.45455	-0.44444	-0.43478	-0.42553	-0.41667
0.9995	-0.47619	-0.46512	-0.45455	-0.44444	-0.43478	-0.42553	-0.41667
0.9990	-0.47619	-0.46512	-0.45455	-0.44444	-0.43478	-0.42553	-0.41667
0.9980	-0.47619	-0.46512	-0.45455	-0.44444	-0.43478	-0.42553	-0.41667
0.9950	-0.47619	-0.46512	-0.45455	-0.44444	-0.43478	-0.42553	-0.41667
0.9900	-0.47619	-0.46512	-0.45455	-0.44444	-0.43478	-0.42553	-0.41667
0.9800	-0.47619	-0.46512	-0.45455	-0.44444	-0.43478	-0.42553	-0.41667
0.9750	-0.47619	-0.46512	-0.45455	-0.44444	-0.43478	-0.42553	-0.41667
0.9600	-0.47619	-0.46512	-0.45455	-0.44444	-0.43478	-0.42553	-0.41667
0.9500	-0.47619	-0.46511	-0.45454	-0.44444	-0.43478	-0.42553	-0.41667
0.9000	-0.47614	-0.46508	-0.45452	-0.44443	-0.43477	-0.42553	-0.41666
0.8000	-0.47504	-0.46428	-0.45395	-0.44402	-0.43448	-0.42532	-0.41652
0.7000	-0.46927	-0.45967	-0.45029	-0.44114	-0.43223	-0.42357	-0.41517
0.6000	-0.45142	-0.44442	-0.43734	-0.43020	-0.42304	-0.41590	-0.40880
0.5704	-0.44212	-0.43623	-0.43016	-0.42394	-0.41761	-0.41121	-0.40477
0.5000	-0.40881	-0.40621	-0.40321	-0.39985	-0.39617	-0.39221	-0.38800
0.4296	-0.35318	-0.35473	-0.35572	-0.35619	-0.35616	-0.35567	-0.35475
0.4000	-0.32049	-0.32400	-0.32693	-0.32928	-0.33108	-0.33236	-0.33315
0.3000	-0.14861	-0.15939	-0.16958	-0.17918	-0.18819	-0.19661	-0.20446
0.2000	0.18967	0.17189	0.15445	0.13737	0.12067	0.10436	0.08847
0.1000	0.96090	0.94064	0.92022	0.89964	0.87895	0.85817	0.83731
0.0500	1.89508	1.88160	1.86757	1.85300	1.83792	1.82234	1.80631
0.0400	2.22024	2.21039	2.19988	2.18874	2.17699	2.16465	2.15174
0.0250	2.93489	2.93443	2.93314	2.93105	2.92818	2.92455	2.92017
0.0200	3.28622	3.29092	3.29473	3.29767	3.29976	3.30103	3.30149
0.0100	4.41706	4.44009	4.46207	4.48303	4.50297	4.52192	4.53990
0.0050	5.59528	5.63934	5.68224	5.72400	5.76464	5.80418	5.84265
0.0020	7.20654	7.28138	7.35497	7.42733	7.49847	7.56842	7.63718
0.0010	8.45646	8.55627	8.65479	8.75202	8.84800	8.94273	9.03623
0.0005	9.72737	9.85326	9.97784	10.10110	10.22307	10.34375	10.46318
0.0001	12.74010	12.92977	13.11808	13.30504	13.49066	13.67495	13.85794

P	G =4.9	G =5.0	G =5.1	G =5.2	G =5.3	G =5.4	G =5.5
0.9999	-0.40816	-0.40000	-0.39216	-0.38462	-0.37736	-0.37037	-0.36364
0.9995	-0.40816	-0.40000	-0.39216	-0.38462	-0.37736	-0.37037	-0.36364
0.9990	-0.40816	-0.40000	-0.39216	-0.38462	-0.37736	-0.37037	-0.36364
0.9980	-0.40816	-0.40000	-0.39216	-0.38462	-0.37736	-0.37037	-0.36364
0.9950	-0.40816	-0.40000	-0.39216	-0.38462	-0.37736	-0.37037	-0.36364
0.9900	-0.40816	-0.40000	-0.39216	-0.38462	-0.37736	-0.37037	-0.36364
0.9800	-0.40816	-0.40000	-0.39216	-0.38462	-0.37736	-0.37037	-0.36364
0.9750	-0.40816	-0.40000	-0.39216	-0.38462	-0.37736	-0.37037	-0.36364
0.9600	-0.40816	-0.40000	-0.39216	-0.38462	-0.37736	-0.37037	-0.36364
0.9500	-0.40816	-0.40000	-0.39216	-0.38462	-0.37736	-0.37037	-0.36364
0.9000	-0.40816	-0.40000	-0.39216	-0.38462	-0.37736	-0.37037	-0.36364
0.8000	-0.40806	-0.39993	-0.39211	-0.38458	-0.37734	-0.37036	-0.36363
0.7000	-0.40703	-0.39914	-0.39152	-0.38414	-0.37701	-0.37011	-0.36345
0.6000	-0.40177	-0.39482	-0.38799	-0.38127	-0.37469	-0.36825	-0.36196
0.5704	-0.39833	-0.39190	-0.38552	-0.37919	-0.37295	-0.36680	-0.36076
0.5000	-0.38359	-0.37901	-0.37428	-0.36945	-0.36453	-0.35956	-0.35456
0.4296	-0.35343	-0.35174	-0.34972	-0.34740	-0.34481	-0.34198	-0.33895
0.4000	-0.33347	-0.33336	-0.33284	-0.33194	-0.33070	-0.32914	-0.32729
0.3000	-0.21172	-0.21843	-0.22458	-0.23019	-0.23527	-0.23984	-0.24391
0.2000	0.07300	0.05798	0.04340	0.02927	0.01561	0.00243	-0.01028
0.1000	0.81641	0.79548	0.77455	0.75364	0.73277	0.71195	0.69122
0.0500	1.78982	1.77292	1.75563	1.73795	1.71992	1.70155	1.68287
0.0400	2.13829	2.12432	2.10985	2.09490	2.07950	2.06365	2.04739
0.0250	2.91508	2.90930	2.90283	2.89572	2.88796	2.87959	2.87062
0.0200	3.30116	3.30007	3.29823	3.29567	3.29240	3.28844	3.28381
0.0100	4.55694	4.57304	4.58823	4.60252	4.61594	4.62850	4.64022
0.0050	5.88004	5.91639	5.95171	5.98602	6.01934	6.05169	6.08307
0.0020	7.70479	7.77124	7.83657	7.90078	7.96390	8.02594	8.08691
0.0010	9.12852	9.21961	9.30952	9.39827	9.48586	9.57232	9.65766
0.0005	10.58135	10.69829	10.81401	10.92853	11.04186	11.15402	11.26502
0.0001	14.03963	14.22004	14.39918	14.57706	14.75370	14.92912	15.10332

P	G =5.6	G =5.7	G =5.8	G =5.9	G =6.0	G =6.1	G =6.2
0.9999	-0.35714	-0.35088	-0.34483	-0.33898	-0.33333	-0.32787	-0.32258
0.9995	-0.35714	-0.35088	-0.34483	-0.33898	-0.33333	-0.32787	-0.32258
0.9990	-0.35714	-0.35088	-0.34483	-0.33898	-0.33333	-0.32787	-0.32258
0.9980	-0.35714	-0.35088	-0.34483	-0.33898	-0.33333	-0.32787	-0.32258
0.9950	-0.35714	-0.35088	-0.34483	-0.33898	-0.33333	-0.32787	-0.32258
0.9900	-0.35714	-0.35088	-0.34483	-0.33898	-0.33333	-0.32787	-0.32258
0.9800	-0.35714	-0.35088	-0.34483	-0.33898	-0.33333	-0.32787	-0.32258
0.9750	-0.35714	-0.35088	-0.34483	-0.33898	-0.33333	-0.32787	-0.32258
0.9600	-0.35714	-0.35088	-0.34483	-0.33898	-0.33333	-0.32787	-0.32258
0.9500	-0.35714	-0.35088	-0.34483	-0.33898	-0.33333	-0.32787	-0.32258
0.9000	-0.35714	-0.35088	-0.34483	-0.33898	-0.33333	-0.32787	-0.32258
0.8000	-0.35714	-0.35087	-0.34483	-0.33898	-0.33333	-0.32787	-0.32258
0.7000	-0.35700	-0.35078	-0.34476	-0.33893	-0.33330	-0.32784	-0.32256
0.6000	-0.35583	-0.34985	-0.34402	-0.33836	-0.33285	-0.32750	-0.32230
0.5704	-0.35484	-0.34903	-0.34336	-0.33782	-0.33242	-0.32715	-0.32202
0.5000	-0.34955	-0.34455	-0.33957	-0.33463	-0.32974	-0.32492	-0.32016
0.4296	-0.33573	-0.33236	-0.32886	-0.32525	-0.32155	-0.31780	-0.31399
0.4000	-0.32519	-0.32285	-0.32031	-0.31759	-0.31472	-0.31171	-0.30859
0.3000	-0.24751	-0.25064	-0.25334	-0.25562	-0.25750	-0.25901	-0.26015
0.2000	-0.02252	-0.03427	-0.04553	-0.05632	-0.06662	-0.07645	-0.08580
0.1000	0.67058	0.65006	0.62966	0.60941	0.58933	0.56942	0.54970
0.0500	1.66390	1.64464	1.62513	1.60538	1.58541	1.56524	1.54487
0.0400	2.03073	2.01369	1.99629	1.97855	1.96048	1.94210	1.92343
0.0250	2.86107	2.85096	2.84030	2.82912	2.81743	2.80525	2.79259
0.0200	3.27854	3.27263	3.26610	3.25898	3.25128	3.24301	3.23419
0.0100	4.65111	4.66120	4.67050	4.67903	4.68680	4.69382	4.70013
0.0050	6.11351	6.14302	6.17162	6.19933	6.22616	6.25212	6.27723
0.0020	8.14683	8.20572	8.26359	8.32046	8.37634	8.43125	8.48519
0.0010	9.74190	9.82505	9.90713	9.98815	10.06812	10.14706	10.22499
0.0005	11.37487	11.48360	11.59122	11.69773	11.80316	11.90752	12.01082
0.0001	15.27632	15.44813	15.61878	15.78826	15.95660	16.12380	16.28989

P	G =6.3	G =6.4	G =6.5	G =6.6	G =6.7	G =6.8	G =6.9
0.9999	-0.31746	-0.31250	-0.30769	-0.30303	-0.29851	-0.29412	-0.28986
0.9995	-0.31746	-0.31250	-0.30769	-0.30303	-0.29851	-0.29412	-0.28986
0.9990	-0.31746	-0.31250	-0.30769	-0.30303	-0.29851	-0.29412	-0.28986
0.9980	-0.31746	-0.31250	-0.30769	-0.30303	-0.29851	-0.29412	-0.28986
0.9950	-0.31746	-0.31250	-0.30769	-0.30303	-0.29851	-0.29412	-0.28986
0.9900	-0.31746	-0.31250	-0.30769	-0.30303	-0.29851	-0.29412	-0.28986
0.9800	-0.31746	-0.31250	-0.30769	-0.30303	-0.29851	-0.29412	-0.28986
0.9750	-0.31746	-0.31250	-0.30769	-0.30303	-0.29851	-0.29412	-0.28986
0.9600	-0.31746	-0.31250	-0.30769	-0.30303	-0.29851	-0.29412	-0.28986
0.9500	-0.31746	-0.31250	-0.30769	-0.30303	-0.29851	-0.29412	-0.28986
0.9000	-0.31746	-0.31250	-0.30769	-0.30303	-0.29851	-0.29412	-0.28986
0.8000	-0.31746	-0.31250	-0.30769	-0.30303	-0.29851	-0.29412	-0.28986
0.7000	-0.31745	-0.31249	-0.30769	-0.30303	-0.29850	-0.29412	-0.28985
0.6000	-0.31724	-0.31234	-0.30757	-0.30294	-0.29844	-0.29407	-0.28982
0.5704	-0.31702	-0.31216	-0.30743	-0.30283	-0.29835	-0.29400	-0.28977
0.5000	-0.31549	-0.31090	-0.30639	-0.30198	-0.29766	-0.29344	-0.28931
0.4296	-0.31016	-0.30631	-0.30246	-0.29862	-0.29480	-0.29101	-0.28726
0.4000	-0.30538	-0.30209	-0.29875	-0.29537	-0.29196	-0.28854	-0.28511
0.3000	-0.26097	-0.26146	-0.26167	-0.26160	-0.26128	-0.26072	-0.25995
0.2000	-0.09469	-0.10311	-0.11107	-0.11859	-0.12566	-0.13231	-0.13853
0.1000	0.53019	0.51089	0.49182	0.47299	0.45440	0.43608	0.41803
0.0500	1.52434	1.50365	1.48281	1.46186	1.44079	1.41963	1.39839
0.0400	1.90449	1.88528	1.86584	1.84616	1.82627	1.80618	1.78591
0.0250	2.77947	2.76591	2.75191	2.73751	2.72270	2.70751	2.69195
0.0200	3.22484	3.21497	3.20460	3.19374	3.18241	3.17062	3.15838
0.0100	4.70571	4.71061	4.71482	4.71836	4.72125	4.72350	4.72512
0.0050	6.30151	6.32497	6.34762	6.36948	6.39055	6.41086	6.43042
0.0020	8.53820	8.59027	8.64142	8.69167	8.74102	8.78950	8.83711
0.0010	10.30192	10.37785	10.45281	10.52681	10.59986	10.67197	10.74316
0.0005	12.11307	12.21429	12.31450	12.41370	12.51190	12.60913	12.70539
0.0001	16.45487	16.61875	16.78156	16.94329	17.10397	17.26361	17.42221

P	G =7.0	G =7.1	G =7.2	G =7.3	G =7.4	G =7.5	G =7.6
0.9999	-0.28571	-0.28169	-0.27778	-0.27397	-0.27027	-0.26667	-0.26316
0.9995	-0.28571	-0.28169	-0.27778	-0.27397	-0.27027	-0.26667	-0.26316
0.9990	-0.28571	-0.28169	-0.27778	-0.27397	-0.27027	-0.26667	-0.26316
0.9980	-0.28571	-0.28169	-0.27778	-0.27397	-0.27027	-0.26667	-0.26316
0.9950	-0.28571	-0.28169	-0.27778	-0.27397	-0.27027	-0.26667	-0.26316
0.9900	-0.28571	-0.28169	-0.27778	-0.27397	-0.27027	-0.26667	-0.26316
0.9800	-0.28571	-0.28169	-0.27778	-0.27397	-0.27027	-0.26667	-0.26316
0.9750	-0.28571	-0.28169	-0.27778	-0.27397	-0.27027	-0.26667	-0.26316
0.9600	-0.28571	-0.28169	-0.27778	-0.27397	-0.27027	-0.26667	-0.26316
0.9500	-0.28571	-0.28169	-0.27778	-0.27397	-0.27027	-0.26667	-0.26316
0.9000	-0.28571	-0.28169	-0.27778	-0.27397	-0.27027	-0.26667	-0.26316
0.8000	-0.28571	-0.28169	-0.27778	-0.27397	-0.27027	-0.26667	-0.26316
0.7000	-0.28571	-0.28169	-0.27778	-0.27397	-0.27027	-0.26667	-0.26316
0.6000	-0.28569	-0.28167	-0.27776	-0.27396	-0.27026	-0.26666	-0.26315
0.5704	-0.28565	-0.28164	-0.27774	-0.27394	-0.27025	-0.26665	-0.26315
0.5000	-0.28528	-0.28135	-0.27751	-0.27376	-0.27010	-0.26654	-0.26306
0.4296	-0.28355	-0.27990	-0.27629	-0.27274	-0.26926	-0.26584	-0.26248
0.4000	-0.28169	-0.27829	-0.27491	-0.27156	-0.26825	-0.26497	-0.26175
0.3000	-0.25899	-0.25785	-0.25654	-0.25510	-0.25352	-0.25183	-0.25005
0.2000	-0.14434	-0.14975	-0.15478	-0.15942	-0.16371	-0.16764	-0.17123
0.1000	0.40026	0.38277	0.36557	0.34868	0.33209	0.31582	0.29986
0.0500	1.37708	1.35571	1.33430	1.31287	1.29141	1.26995	1.24850
0.0400	1.76547	1.74487	1.72412	1.70325	1.68225	1.66115	1.63995
0.0250	2.67603	2.65977	2.64317	2.62626	2.60905	2.59154	2.57375
0.0200	3.14572	3.13263	3.11914	3.10525	3.09099	3.07636	3.06137
0.0100	4.72613	4.72653	4.72635	4.72559	4.72427	4.72240	4.71998
0.0050	6.44924	6.46733	6.48470	6.50137	6.51735	6.53264	6.54727
0.0020	8.88387	8.92979	8.97488	9.01915	9.06261	9.10528	9.14717
0.0010	10.81343	10.88281	10.95129	11.01890	11.08565	11.15154	11.21658
0.0005	12.80069	12.89505	12.98848	13.08098	13.17258	13.26328	13.35309
0.0001	17.57979	17.73636	17.89193	18.04652	18.20013	18.35278	18.50447

P	G =7.7	G =7.8	G =7.9	G =8.0	G =8.1	G =8.2	G =8.3
0.9999	-0.25974	-0.25641	-0.25316	-0.25000	-0.24691	-0.24390	-0.24096
0.9995	-0.25974	-0.25641	-0.25316	-0.25000	-0.24691	-0.24390	-0.24096
0.9990	-0.25974	-0.25641	-0.25316	-0.25000	-0.24691	-0.24390	-0.24096
0.9980	-0.25974	-0.25641	-0.25316	-0.25000	-0.24691	-0.24390	-0.24096
0.9950	-0.25974	-0.25641	-0.25316	-0.25000	-0.24691	-0.24390	-0.24096
0.9900	-0.25974	-0.25641	-0.25316	-0.25000	-0.24691	-0.24390	-0.24096
0.9800	-0.25974	-0.25641	-0.25316	-0.25000	-0.24691	-0.24390	-0.24096
0.9750	-0.25974	-0.25641	-0.25316	-0.25000	-0.24691	-0.24390	-0.24096
0.9600	-0.25974	-0.25641	-0.25316	-0.25000	-0.24691	-0.24390	-0.24096
0.9500	-0.25974	-0.25641	-0.25316	-0.25000	-0.24691	-0.24390	-0.24096
0.9000	-0.25974	-0.25641	-0.25316	-0.25000	-0.24691	-0.24390	-0.24096
0.8000	-0.25974	-0.25641	-0.25316	-0.25000	-0.24691	-0.24390	-0.24096
0.7000	-0.25974	-0.25641	-0.25316	-0.25000	-0.24691	-0.24390	-0.24096
0.6000	-0.25974	-0.25641	-0.25316	-0.25000	-0.24691	-0.24390	-0.24096
0.5704	-0.25973	-0.25640	-0.25316	-0.25000	-0.24691	-0.24390	-0.24096
0.5000	-0.25966	-0.25635	-0.25312	-0.24996	-0.24689	-0.24388	-0.24095
0.4296	-0.25919	-0.25596	-0.25280	-0.24970	-0.24667	-0.24371	-0.24081
0.4000	-0.25857	-0.25544	-0.25236	-0.24933	-0.24637	-0.24345	-0.24060
0.3000	-0.24817	-0.24622	-0.24421	-0.24214	-0.24003	-0.23788	-0.23571
0.2000	-0.17450	-0.17746	-0.18012	-0.18249	-0.18459	-0.18643	-0.18803
0.1000	0.28422	0.26892	0.25394	0.23929	0.22498	0.21101	0.19737
0.0500	1.22706	1.20565	1.18427	1.16295	1.14168	1.12048	1.09936
0.0400	1.61867	1.59732	1.57591	1.55444	1.53294	1.51141	1.48985
0.0250	2.55569	2.53737	2.51881	2.50001	2.48099	2.46175	2.44231
0.0200	3.04604	3.03038	3.01439	2.99810	2.98150	2.96462	2.94746
0.0100	4.71704	4.71358	4.70961	4.70514	4.70019	4.69476	4.68887
0.0050	6.56124	6.57456	6.58725	6.59931	6.61075	6.62159	6.63183
0.0020	9.18828	9.22863	9.26823	9.30709	9.34521	9.38262	9.41931
0.0010	11.28080	11.34419	11.40677	11.46855	11.52953	11.58974	11.64917
0.0005	13.44202	13.53009	13.61730	13.70366	13.78919	13.87389	13.95778
0.0001	18.65522	18.80504	18.95393	19.10191	19.24898	19.39517	19.54046

P	G =8.4	G =8.5	G =8.6	G =8.7	G =8.8	G =8.9	G =9.0
0.9999	-0.23810	-0.23529	-0.23256	-0.22989	-0.22727	-0.22472	-0.22222
0.9995	-0.23810	-0.23529	-0.23256	-0.22989	-0.22727	-0.22472	-0.22222
0.9990	-0.23810	-0.23529	-0.23256	-0.22989	-0.22727	-0.22472	-0.22222
0.9980	-0.23810	-0.23529	-0.23256	-0.22989	-0.22727	-0.22472	-0.22222
0.9950	-0.23810	-0.23529	-0.23256	-0.22989	-0.22727	-0.22472	-0.22222
0.9900	-0.23810	-0.23529	-0.23256	-0.22989	-0.22727	-0.22472	-0.22222
0.9800	-0.23810	-0.23529	-0.23256	-0.22989	-0.22727	-0.22472	-0.22222
0.9750	-0.23810	-0.23529	-0.23256	-0.22989	-0.22727	-0.22472	-0.22222
0.9600	-0.23810	-0.23529	-0.23256	-0.22989	-0.22727	-0.22472	-0.22222
0.9500	-0.23810	-0.23529	-0.23256	-0.22989	-0.22727	-0.22472	-0.22222
0.9000	-0.23810	-0.23529	-0.23256	-0.22989	-0.22727	-0.22472	-0.22222
0.8000	-0.23810	-0.23529	-0.23256	-0.22989	-0.22727	-0.22472	-0.22222
0.7000	-0.23810	-0.23529	-0.23256	-0.22989	-0.22727	-0.22472	-0.22222
0.6000	-0.23810	-0.23529	-0.23256	-0.22988	-0.22727	-0.22472	-0.22222
0.5704	-0.23809	-0.23529	-0.23256	-0.22988	-0.22727	-0.22472	-0.22222
0.5000	-0.23808	-0.23528	-0.23255	-0.22988	-0.22727	-0.22472	-0.22222
0.4296	-0.23797	-0.23520	-0.23248	-0.22982	-0.22722	-0.22468	-0.22219
0.4000	-0.23779	-0.23505	-0.23236	-0.22972	-0.22714	-0.22461	-0.22214
0.3000	-0.23352	-0.23132	-0.22911	-0.22690	-0.22469	-0.22249	-0.22030
0.2000	-0.18939	-0.19054	-0.19147	-0.19221	-0.19277	-0.19316	-0.19338
0.1000	0.18408	0.17113	0.15851	0.14624	0.13431	0.12272	0.11146
0.0500	1.07832	1.05738	1.03654	1.01581	0.99519	0.97471	0.95435
0.0400	1.46829	1.44673	1.42518	1.40364	1.38213	1.36065	1.33922
0.0250	2.42268	2.40287	2.38288	2.36273	2.34242	2.32197	2.30138
0.0200	2.93002	2.91234	2.89440	2.87622	2.85782	2.83919	2.82035
0.0100	4.68252	4.67573	4.66850	4.66085	4.65277	4.64429	4.63541
0.0050	6.64148	6.65056	6.65907	6.66703	6.67443	6.68130	6.68763
0.0020	9.45530	9.49060	9.52521	9.55915	9.59243	9.62504	9.65701
0.0010	11.70785	11.76576	11.82294	11.87938	11.93509	11.99009	12.04437
0.0005	14.04086	14.12314	14.20463	14.28534	14.36528	14.44446	14.52288
0.0001	19.68489	19.82845	19.97115	20.11300	20.25402	20.39420	20.53356

P	G = -0.0	G = -0.1	G = -0.2	G = -0.3	G = -0.4	G = -0.5	G = -0.6
0.9999	-3.71902	-3.93453	-4.15301	-4.37394	-4.59687	-4.82141	-5.04718
0.9995	-3.29053	-3.45513	-3.62113	-3.78820	-3.95605	-4.12443	-4.29311
0.9990	-3.09023	-3.23322	-3.37703	-3.52139	-3.66608	-3.81090	-3.95567
0.9980	-2.87816	-2.99978	-3.12169	-3.24371	-3.36566	-3.48737	-3.60872
0.9950	-2.57583	-2.66965	-2.76321	-2.85636	-2.94900	-3.04102	-3.13232
0.9900	-2.32635	-2.39951	-2.47226	-2.54421	-2.61539	-2.68572	-2.75514
0.9800	-2.05375	-2.10697	-2.15935	-2.21081	-2.26133	-2.31084	-2.35931
0.9750	-1.95996	-2.00688	-2.05290	-2.09795	-2.14202	-2.18505	-2.22702
0.9600	-1.75069	-1.78462	-1.81756	-1.84949	-1.88039	-1.91022	-1.93896
0.9500	-1.64485	-1.67279	-1.69971	-1.72562	-1.75048	-1.77428	-1.79701
0.9000	-1.28155	-1.29178	-1.30105	-1.30936	-1.31671	-1.32309	-1.32850
0.8000	-0.84162	-0.83639	-0.83044	-0.82377	-0.81638	-0.80829	-0.79950
0.7000	-0.52440	-0.51207	-0.49927	-0.48600	-0.47228	-0.45812	-0.44352
0.6000	-0.25335	-0.23763	-0.22168	-0.20552	-0.18916	-0.17261	-0.15589
0.5704	-0.17733	-0.16111	-0.14472	-0.12820	-0.11154	-0.09478	-0.07791
0.5000	0.0	0.01662	0.03325	0.04993	0.06651	0.08302	0.09945
0.4296	0.17733	0.19339	0.20925	0.22492	0.24037	0.25558	0.27047
0.4000	0.25335	0.26882	0.28403	0.29897	0.31362	0.32796	0.34198
0.3000	0.52440	0.53624	0.54757	0.55839	0.56867	0.57840	0.58757
0.2000	0.84162	0.84611	0.84986	0.85285	0.85508	0.85653	0.85718
0.1000	1.28155	1.27037	1.25824	1.24516	1.23114	1.21618	1.20028
0.0500	1.64485	1.61594	1.58607	1.55527	1.52357	1.49101	1.45762
0.0400	1.75069	1.71580	1.67999	1.64329	1.60574	1.56740	1.52830
0.0250	1.95996	1.91219	1.86360	1.81427	1.76427	1.71366	1.66253
0.0200	2.05375	1.99973	1.94499	1.88959	1.83361	1.77716	1.72033
0.0100	2.32635	2.25258	2.17840	2.10394	2.02933	1.95472	1.88029
0.0050	2.57583	2.48187	2.38795	2.29423	2.20092	2.10825	2.01644
0.0020	2.87816	2.75706	2.63672	2.51741	2.39942	2.28311	2.16884
0.0010	3.09023	2.94834	2.80786	2.66915	2.53261	2.39867	2.26780
0.0005	3.29053	3.12767	2.96648	2.80889	2.65390	2.50257	2.35549
0.0001	3.71902	3.50703	3.29921	3.09631	2.89907	2.70836	2.52507

P	G1=-0.7	G1=-0.8	G1=-0.9	G1=-1.0	G1=-1.1	G1=-1.2	G1=-1.3
0.9999	-5.27389	-5.50124	-5.72899	-5.95691	-6.18480	-6.41249	-6.63980
0.9995	-4.46184	-4.63057	-4.79899	-4.96701	-5.13449	-5.30130	-5.46735
0.9990	-4.10022	-4.24439	-4.38807	-4.53112	-4.67344	-4.81492	-4.95549
0.9980	-3.72957	-3.84981	-3.96932	-4.08802	-4.20582	-4.32263	-4.43839
0.9950	-3.22281	-3.31243	-3.40109	-3.48874	-3.57530	-3.66073	-3.74497
0.9900	-2.82359	-2.89101	-2.95735	-3.02256	-3.08660	-3.14944	-3.21103
0.9800	-2.40570	-2.45298	-2.49811	-2.54206	-2.58480	-2.62631	-2.66657
0.9750	-2.26790	-2.30764	-2.34623	-2.38364	-2.41984	-2.45482	-2.48855
0.9600	-1.96660	-1.99311	-2.01848	-2.04269	-2.06573	-2.08758	-2.10823
0.9500	-1.81864	-1.83916	-1.85856	-1.87683	-1.89395	-1.90992	-1.92472
0.9000	-1.33294	-1.33640	-1.33899	-1.34039	-1.34092	-1.34047	-1.33904
0.8000	-0.79002	-0.77986	-0.76902	-0.75752	-0.74537	-0.73257	-0.71915
0.7000	-0.42851	-0.41309	-0.39729	-0.38111	-0.36458	-0.34772	-0.33054
0.6000	-0.13901	-0.12199	-0.10486	-0.08763	-0.07032	-0.05297	-0.03560
0.5704	-0.06097	-0.04397	-0.02693	-0.00987	0.00719	0.02421	0.04116
0.5000	0.11578	0.13199	0.14807	0.16397	0.17968	0.19517	0.21040
0.4296	0.28516	0.29961	0.31368	0.32740	0.34075	0.35370	0.36620
0.4000	0.35565	0.36889	0.38186	0.39434	0.40638	0.41794	0.42899
0.3000	0.59615	0.60412	0.61146	0.61815	0.62415	0.62944	0.63400
0.2000	0.85703	0.85607	0.85426	0.85161	0.84809	0.84369	0.83841
0.1000	1.18347	1.16574	1.14712	1.12762	1.10726	1.08608	1.06413
0.0500	1.42345	1.39855	1.37299	1.34684	1.28019	1.24313	1.20578
0.0400	1.48852	1.44813	1.40720	1.36584	1.32414	1.28225	1.24028
0.0250	1.61099	1.55914	1.50712	1.45507	1.40314	1.35153	1.30042
0.0200	1.66325	1.60604	1.54886	1.49188	1.43529	1.37929	1.32412
0.0100	1.80621	1.73271	1.66001	1.58838	1.51808	1.44942	1.38267
0.0050	1.92590	1.83660	1.74919	1.66390	1.58110	1.50114	1.42439
0.0020	2.05701	1.94806	1.84244	1.74062	1.64305	1.55016	1.46232
0.0010	2.14053	2.01739	1.89894	-1.78572	1.67825	1.57695	1.48216
0.0005	2.21328	2.07661	1.94611	1.82241	1.70603	1.59738	1.49673
0.0001	2.35015	2.18448	2.02891	1.88410	1.75053	1.62838	1.51752

P	G =-1.4	G =-1.5	G =-1.6	G =-1.7	G =-1.8	G =-1.9	G =-2.0
0.9999	-6.86661	-7.09277	-7.31918	-7.54272	-7.76632	-7.98888	-8.21034
0.9995	-5.63252	-5.79673	-5.95990	-6.12196	-6.28285	-6.44251	-6.60090
0.9990	-5.09505	-5.23353	-5.37087	-5.50701	-5.64190	-5.77549	-5.90776
0.9980	-4.55304	-4.66651	-4.77875	-4.88971	-4.99937	-5.10768	-5.21461
0.9950	-3.82798	-3.90973	-3.99016	-4.06926	-4.14700	-4.22336	-4.29832
0.9900	-3.27134	-3.33035	-3.38804	-3.44438	-3.49935	-3.55295	-3.60517
0.9800	-2.70556	-2.74325	-2.77964	-2.81472	-2.84848	-2.88091	-2.91202
0.9750	-2.52102	-2.55222	-2.58214	-2.61076	-2.63810	-2.66413	-2.68888
0.9600	-2.12768	-2.14591	-2.16293	-2.17873	-2.19332	-2.20670	-2.21888
0.9500	-1.93836	-1.95083	-1.96213	-1.97227	-1.98124	-1.98906	-1.99573
0.9000	-1.33665	-1.33330	-1.32900	-1.32376	-1.31760	-1.31054	-1.30259
0.8000	-0.70512	-0.69050	-0.67532	-0.65959	-0.64335	-0.62662	-0.60944
0.7000	-0.31307	-0.29535	-0.27740	-0.25925	-0.24094	-0.22250	-0.20397
0.6000	-0.01824	-0.00092	0.01631	0.03344	0.05040	0.06718	0.08371
0.5704	0.05803	0.07476	0.09132	0.10769	0.12381	0.13964	0.15516
0.5000	0.22535	0.23996	0.25422	0.26808	0.28150	0.29443	0.30685
0.4296	0.37824	0.38977	0.40075	0.41116	0.42095	0.43008	0.43854
0.4000	0.43949	0.44942	0.45873	0.46739	0.47538	0.48265	0.48917
0.3000	0.63779	0.64080	0.64300	0.64436	0.64488	0.64453	0.64333
0.2000	0.83223	0.82516	0.81720	0.80837	0.79868	0.78816	0.77686
0.1000	1.04144	1.01810	0.99418	0.96977	0.94496	0.91988	0.89464
0.0500	1.16827	1.13075	1.09338	1.05631	1.01973	0.98381	0.94871
0.0400	1.19842	1.15682	1.11566	1.07513	1.03543	0.99672	0.95918
0.0250	1.25004	1.20059	1.15229	1.10537	1.06001	1.01640	0.97468
0.0200	1.26999	1.21716	1.16584	1.11628	1.06864	1.02311	0.97980
0.0100	1.31815	1.25611	1.19680	1.14042	1.08711	1.03695	0.98995
0.0050	1.35114	1.28167	1.21618	1.15477	1.09749	1.04427	0.99499
0.0020	1.37981	1.30279	1.23132	1.16534	1.10465	1.04898	0.99800
0.0010	1.39408	1.31275	1.23805	1.16974	1.10743	1.05068	0.99900
0.0005	1.40413	1.31944	1.24235	1.17240	1.10901	1.05159	0.99950
0.0001	1.41753	1.32774	1.24728	1.17520	1.11054	1.05239	0.99990

P	G =-2.1	G =-2.2	G =-2.3	G =-2.4	G =-2.5	G =-2.6	G1=-2.7
0.9999	-8.43064	-8.64971	-8.86753	-9.08403	-9.29920	-9.51301	-9.72543
0.9995	-6.75798	-6.91370	-7.06804	-7.22098	-7.37250	-7.52258	-7.67121
0.9990	-6.03865	-6.16816	-6.29626	-6.42292	-6.54814	-6.67191	-6.79421
0.9980	-5.32014	-5.42426	-5.52694	-5.62818	-5.72796	-5.82629	-5.92316
0.9950	-4.37186	-4.44398	-4.51467	-4.58393	-4.65176	-4.71815	-4.78313
0.9900	-3.65600	-3.70543	-3.75347	-3.80013	-3.84540	-3.88930	-3.93183
0.9800	-2.94181	-2.97028	-2.99744	-3.02330	-3.04787	-3.07116	-3.09320
0.9750	-2.71234	-2.73451	-2.75541	-2.77506	-2.79345	-2.81062	-2.82658
0.9600	-2.22986	-2.23967	-2.24831	-2.25581	-2.26217	-2.26743	-2.27160
0.9500	-2.00128	-2.00570	-2.00903	-2.01128	-2.01247	-2.01263	-2.01177
0.9000	-1.29377	-1.28412	-1.27365	-1.26240	-1.25039	-1.23766	-1.22422
0.8000	-0.59183	-0.57383	-0.55549	-0.53683	-0.51789	-0.49872	-0.47934
0.7000	-0.18540	-0.16682	-0.14827	-0.12979	-0.11143	-0.09323	-0.07523
0.6000	0.09997	0.11590	0.13148	0.14665	0.16138	0.17564	0.18939
0.5704	0.17030	0.18504	0.19933	0.21313	0.22642	0.23915	0.25129
0.5000	0.31872	0.32999	0.34063	0.35062	0.35992	0.36852	0.37640
0.4296	0.44628	0.45329	0.45953	0.46499	0.46966	0.47353	0.47660
0.4000	0.49494	0.49991	0.50409	0.50744	0.50999	0.51171	0.51263
0.3000	0.64125	0.63833	0.63456	0.62999	0.62463	0.61854	0.61176
0.2000	0.76482	0.75211	0.73880	0.72495	0.71067	0.69602	0.68111
0.1000	0.86938	0.84422	0.81929	0.79472	0.77062	0.74709	0.72422
0.0500	0.91458	0.88156	0.84976	0.81927	0.79015	0.76242	0.73610
0.0400	0.92295	0.88814	0.85486	0.82315	0.79306	0.76456	0.73765
0.0250	0.93495	0.89728	0.86169	0.82817	0.79667	0.76712	0.73943
0.0200	0.93878	0.90009	0.86371	0.82959	0.79765	0.76779	0.73987
0.0100	0.94607	0.90521	0.86723	0.83196	0.79921	0.76878	0.74049
0.0050	0.94945	0.90742	0.86863	0.83283	0.79973	0.76909	0.74067
0.0020	0.95131	0.90854	0.86929	0.83320	0.79994	0.76920	0.74073
0.0010	0.95188	0.90885	0.86945	0.83328	0.79998	0.76922	0.74074
0.0005	0.95215	0.90899	0.86952	0.83331	0.79999	0.76923	0.74074
0.0001	0.95234	0.90908	0.86956	0.83333	0.80000	0.76923	0.74074

P	G =-2.8	G =-2.9	G =-3.0	G =-3.1	G =-3.2	G =-3.3	G1=-3.4
0.9999	-9.93643	-10.14602	-10.35418	-10.56090	-10.76618	-10.97001	-11.17239
0.9995	-7.81839	-7.96411	-8.10836	-8.25115	-8.39248	-8.53236	-8.67079
0.9990	-6.91505	-7.03443	-7.15235	-7.26881	-7.38382	-7.49739	-7.60953
0.9980	-6.01858	-6.11254	-6.20506	-6.29613	-6.38578	-6.47401	-6.56084
0.9950	-4.84669	-4.90884	-4.96959	-5.02897	-5.08697	-5.14362	-5.19892
0.9900	-3.97301	-4.01286	-4.05138	-4.08859	-4.12452	-4.15917	-4.19257
0.9800	-3.11399	-3.13356	-3.15193	-3.16911	-3.18512	-3.20000	-3.21375
0.9750	-2.84134	-2.85492	-2.86735	-2.87865	-2.88884	-2.89795	-2.90599
0.9600	-2.27470	-2.27676	-2.27780	-2.27785	-2.27693	-2.27506	-2.27229
0.9500	-2.00992	-2.00710	-2.00335	-1.99869	-1.99314	-1.98674	-1.97951
0.9000	-1.21013	-1.19539	-1.18006	-1.16416	-1.14772	-1.13078	-1.11337
0.8000	-0.45980	-0.44015	-0.42040	-0.40061	-0.38081	-0.36104	-0.34133
0.7000	-0.05746	-0.03997	-0.02279	-0.00596	0.01050	0.02654	0.04215
0.6000	0.20259	0.21523	0.22726	0.23868	0.24946	0.25958	0.26904
0.5704	0.26282	0.27372	0.28395	0.29351	0.30238	0.31055	0.31802
0.5000	0.38353	0.38991	0.39554	0.40041	0.40454	0.40792	0.41058
0.4296	0.47888	0.48037	0.48109	0.48107	0.48033	0.47890	0.47682
0.4000	0.51276	0.51212	0.51073	0.50863	0.50585	0.50244	0.49844
0.3000	0.60434	0.59634	0.58783	0.57887	0.56953	0.55989	0.55000
0.2000	0.66603	0.65086	0.63569	0.62060	0.60567	0.59096	0.57652
0.1000	0.70209	0.68075	0.66023	0.64056	0.62175	0.60379	0.58666
0.0500	0.71116	0.68759	0.66532	0.64429	0.62445	0.60572	0.58802
0.0400	0.71227	0.68836	0.66585	0.64465	0.62469	0.60587	0.58812
0.0250	0.71348	0.68917	0.66638	0.64500	0.62491	0.60601	0.58821
0.0200	0.71377	0.68935	0.66649	0.64507	0.62495	0.60603	0.58822
0.0100	0.71415	0.68959	0.66663	0.64514	0.62499	0.60606	0.58823
0.0050	0.71425	0.68964	0.66666	0.64516	0.62500	0.60606	0.58824
0.0020	0.71428	0.68965	0.66667	0.64516	0.62500	0.60606	0.58824
0.0010	0.71428	0.68965	0.66667	0.64516	0.62500	0.60606	0.58824
0.0005	0.71429	0.68966	0.66667	0.64516	0.62500	0.60606	0.58824
0.0001	0.71429	0.68966	0.66667	0.64516	0.62500	0.60606	0.58824

P	G =-3.5	G =-3.6	G =-3.7	G =-3.8	G =-3.9	G =-4.0	G =-4.1
0.9999	-11.37334	-11.57284	-11.77092	-11.96757	-12.16280	-12.35663	-12.54906
0.9995	-8.80779	-8.94335	-9.07750	-9.21023	-9.34158	-9.47154	-9.60013
0.9990	-7.72024	-7.82954	-7.93744	-8.04395	-8.14910	-8.25289	-8.35534
0.9980	-6.64627	-6.73032	-6.81301	-6.89435	-6.97435	-7.05304	-7.13043
0.9950	-5.25291	-5.30559	-5.35698	-5.40711	-5.45598	-5.50362	-5.55005
0.9900	-4.22473	-4.25569	-4.28545	-4.31403	-4.34147	-4.36777	-4.39296
0.9800	-3.22641	-3.23800	-3.24853	-3.25803	-3.26653	-3.27404	-3.28060
0.9750	-2.91299	-2.91898	-2.92397	-2.92799	-2.93107	-2.93324	-2.93450
0.9600	-2.26862	-2.26409	-2.25872	-2.25254	-2.24558	-2.23786	-2.22940
0.9500	-1.97147	-1.96266	-1.95311	-1.94283	-1.93186	-1.92023	-1.90796
0.9000	-1.09552	-1.07726	-1.05863	-1.03965	-1.02036	-1.00079	-0.98096
0.8000	-0.32171	-0.30223	-0.28290	-0.26376	-0.24484	-0.22617	-0.20777
0.7000	0.05730	0.07195	0.08610	0.09972	0.11279	0.12530	0.13725
0.6000	0.27782	0.28592	0.29335	0.30010	0.30617	0.31159	0.31635
0.5704	0.32479	0.33085	0.33623	0.34092	0.34494	0.34831	0.35105
0.5000	0.41253	0.41381	0.41442	0.41441	0.41381	0.41265	0.41097
0.4296	0.47413	0.47088	0.46711	0.46286	0.45819	0.45314	0.44777
0.4000	0.49391	0.48888	0.48342	0.47758	0.47141	0.46496	0.45828
0.3000	0.53993	0.52975	0.51952	0.50929	0.49911	0.48902	0.47906
0.2000	0.56242	0.54867	0.53533	0.52240	0.50990	0.49784	0.48622
0.1000	0.57035	0.55483	0.54006	0.52600	0.51261	0.49986	0.48772
0.0500	0.57130	0.55548	0.54050	0.52629	0.51281	0.49999	0.48780
0.0400	0.57136	0.55552	0.54052	0.52630	0.51281	0.50000	0.48780
0.0250	0.57141	0.55555	0.54054	0.52631	0.51282	0.50000	0.48780
0.0200	0.57142	0.55555	0.54054	0.52631	0.51282	0.50000	0.48780
0.0100	0.57143	0.55556	0.54054	0.52632	0.51282	0.50000	0.48780
0.0050	0.57143	0.55556	0.54054	0.52632	0.51282	0.50000	0.48780
0.0020	0.57143	0.55556	0.54054	0.52632	0.51282	0.50000	0.48780
0.0010	0.57143	0.55556	0.54054	0.52632	0.51282	0.50000	0.48780
0.0005	0.57143	0.55556	0.54054	0.52632	0.51282	0.50000	0.48780
0.0001	0.57143	0.55556	0.54054	0.52632	0.51282	0.50000	0.48780

P	G = -4.2	G = -4.3	G = -4.4	G = -4.5	G = -4.6	G = -4.7	G = -4.8
0.9999	-12.74010	-12.92977	-13.11808	-13.30504	-13.49066	-13.67495	-13.85794
0.9995	-9.72737	-9.85326	-9.97784	-10.10110	-10.22307	-10.34375	-10.46318
0.9990	-8.45646	-8.55627	-8.65479	-8.75202	-8.84800	-8.94273	-9.03623
0.9980	-7.20654	-7.28138	-7.35497	-7.42733	-7.49847	-7.56842	-7.63718
0.9950	-5.59528	-5.63934	-5.68224	-5.72400	-5.76464	-5.80418	-5.84265
0.9900	-4.41706	-4.44009	-4.46207	-4.48303	-4.50297	-4.52192	-4.53990
0.9800	-3.28622	-3.29092	-3.29473	-3.29767	-3.29976	-3.30103	-3.30149
0.9750	-2.93489	-2.93443	-2.93314	-2.93105	-2.92818	-2.92455	-2.92017
0.9600	-2.22024	-2.21039	-2.19988	-2.18874	-2.17699	-2.16465	-2.15174
0.9500	-1.89508	-1.88160	-1.86757	-1.85300	-1.83792	-1.82234	-1.80631
0.9000	-0.96090	-0.94064	-0.92022	-0.89964	-0.87895	-0.85817	-0.83731
0.8000	-0.18967	-0.17189	-0.15445	-0.13737	-0.12067	-0.10436	-0.08847
0.7000	0.14861	0.15939	0.16958	0.17918	0.18819	0.19661	0.20446
0.6000	0.32049	0.32400	0.32693	0.32928	0.33108	0.33236	0.33315
0.5704	0.35318	0.35473	0.35572	0.35619	0.35616	0.35567	0.35475
0.5000	0.40881	0.40621	0.40321	0.39985	0.39617	0.39221	0.38800
0.4296	0.44212	0.43623	0.43016	0.42394	0.41761	0.41121	0.40477
0.4000	0.45142	0.44442	0.43734	0.43020	0.42304	0.41590	0.40880
0.3000	0.46927	0.45967	0.45029	0.44114	0.43223	0.42357	0.41517
0.2000	0.47504	0.46428	0.45395	0.44402	0.43448	0.42532	0.41652
0.1000	0.47614	0.46508	0.45452	0.44443	0.43477	0.42553	0.41666
0.0500	0.47619	0.46511	0.45454	0.44444	0.43478	0.42553	0.41667
0.0400	0.47619	0.46512	0.45455	0.44444	0.43478	0.42553	0.41667
0.0250	0.47619	0.46512	0.45455	0.44444	0.43478	0.42553	0.41667
0.0200	0.47619	0.46512	0.45455	0.44444	0.43478	0.42553	0.41667
0.0100	0.47619	0.46512	0.45455	0.44444	0.43478	0.42553	0.41667
0.0050	0.47619	0.46512	0.45455	0.44444	0.43478	0.42553	0.41667
0.0020	0.47619	0.46512	0.45455	0.44444	0.43478	0.42553	0.41667
0.0010	0.47619	0.46512	0.45455	0.44444	0.43478	0.42553	0.41667
0.0005	0.47619	0.46512	0.45455	0.44444	0.43478	0.42553	0.41667
0.0001	0.47619	0.46512	0.45455	0.44444	0.43478	0.42553	0.41667

P	G = -4.9	G = -5.0	G = -5.1	G = -5.2	G = -5.3	G = -5.4	G = -5.5
0.9999	-14.03963	-14.22004	-14.39918	-14.57706	-14.75370	-14.92912	-15.10332
0.9995	-10.58135	-10.69829	-10.81401	-10.92853	-11.04186	-11.15402	-11.26502
0.9990	-9.12852	-9.21961	-9.30952	-9.39827	-9.48586	-9.57232	-9.65766
0.9980	-7.70479	-7.77124	-7.83657	-7.90078	-7.96390	-8.02594	-8.08691
0.9950	-5.88004	-5.91639	-5.95171	-5.98602	-6.01934	-6.05169	-6.08307
0.9900	-4.55694	-4.57304	-4.58823	-4.60252	-4.61594	-4.62850	-4.64022
0.9800	-3.30116	-3.30007	-3.29823	-3.29567	-3.29240	-3.28844	-3.28381
0.9750	-2.91508	-2.90930	-2.90283	-2.89572	-2.88796	-2.87959	-2.87062
0.9600	-2.13829	-2.12432	-2.10985	-2.09490	-2.07950	-2.06365	-2.04739
0.9500	-1.78982	-1.77292	-1.75563	-1.73795	-1.71992	-1.70155	-1.68287
0.9000	-0.81641	-0.79548	-0.77455	-0.75364	-0.73277	-0.71195	-0.69122
0.8000	-0.07300	-0.05798	-0.04340	-0.02927	-0.01561	-0.00243	0.01028
0.7000	0.21172	0.21843	0.22458	0.23019	0.23527	0.23984	0.24391
0.6000	0.33347	0.33336	0.33284	0.33194	0.33070	0.32914	0.32729
0.5704	0.35343	0.35174	0.34972	0.34740	0.34481	0.34198	0.33895
0.5000	0.38359	0.37901	0.37428	0.36945	0.36453	0.35956	0.35456
0.4296	0.39833	0.39190	0.38552	0.37919	0.37295	0.36680	0.36076
0.4000	0.40177	0.39482	0.38799	0.38127	0.37469	0.36825	0.36196
0.3000	0.40703	0.39914	0.39152	0.38414	0.37701	0.37011	0.36345
0.2000	0.40806	0.39993	0.39211	0.38458	0.37734	0.37036	0.36363
0.1000	0.40816	0.40000	0.39216	0.38462	0.37736	0.37037	0.36364
0.0500	0.40816	0.40000	0.39216	0.38462	0.37736	0.37037	0.36364
0.0400	0.40816	0.40000	0.39216	0.38462	0.37736	0.37037	0.36364
0.0250	0.40816	0.40000	0.39216	0.38462	0.37736	0.37037	0.36364
0.0200	0.40816	0.40000	0.39216	0.38462	0.37736	0.37037	0.36364
0.0100	0.40816	0.40000	0.39216	0.38462	0.37736	0.37037	0.36364
0.0050	0.40816	0.40000	0.39216	0.38462	0.37736	0.37037	0.36364
0.0020	0.40816	0.40000	0.39216	0.38462	0.37736	0.37037	0.36364
0.0010	0.40816	0.40000	0.39216	0.38462	0.37736	0.37037	0.36364
0.0005	0.40816	0.40000	0.39216	0.38462	0.37736	0.37037	0.36364
0.0001	0.40816	0.40000	0.39216	0.38462	0.37736	0.37037	0.36364

P	G = -5.6	G = -5.7	G = -5.8	G = -5.9	G = -6.0	G = -6.1	G = -6.2
0.9999	-15.27632	-15.44813	-15.61878	-15.78826	-15.95660	-16.12380	-16.28989
0.9995	-11.37487	-11.48360	-11.59122	-11.69773	-11.80316	-11.90752	-12.01082
0.9990	-9.74190	-9.82505	-9.90713	-9.98815	-10.06812	-10.14706	-10.22499
0.9980	-8.14683	-8.20572	-8.26359	-8.32046	-8.37634	-8.43125	-8.48519
0.9950	-6.11351	-6.14302	-6.17162	-6.19933	-6.22616	-6.25212	-6.27723
0.9900	-4.65111	-4.66120	-4.67050	-4.67903	-4.68680	-4.69382	-4.70013
0.9800	-3.27854	-3.27263	-3.26610	-3.25898	-3.25128	-3.24301	-3.23419
0.9750	-2.86107	-2.85096	-2.84030	-2.82912	-2.81743	-2.80525	-2.79259
0.9600	-2.03073	-2.01369	-1.99629	-1.97855	-1.96048	-1.94210	-1.92343
0.9500	-1.66390	-1.64464	-1.62513	-1.60538	-1.58541	-1.56524	-1.54487
0.9000	-0.67058	-0.65006	-0.62966	-0.60941	-0.58933	-0.56942	-0.54970
0.8000	0.02252	0.03427	0.04553	0.05632	0.06662	0.07645	0.08580
0.7000	0.24751	0.25064	0.25334	0.25562	0.25750	0.25901	0.26015
0.6000	0.32519	0.32285	0.32031	0.31759	0.31472	0.31171	0.30859
0.5704	0.33573	0.33236	0.32886	0.32525	0.32155	0.31780	0.31399
0.5000	0.34955	0.34455	0.33957	0.33463	0.32974	0.32492	0.32016
0.4296	0.35484	0.34903	0.34336	0.33782	0.33242	0.32715	0.32202
0.4000	0.35583	0.34985	0.34402	0.33836	0.33285	0.32750	0.32230
0.3000	0.35700	0.35078	0.34476	0.33893	0.33330	0.32784	0.32256
0.2000	0.35714	0.35087	0.34483	0.33898	0.33333	0.32787	0.32258
0.1000	0.35714	0.35088	0.34483	0.33898	0.33333	0.32787	0.32258
0.0500	0.35714	0.35088	0.34483	0.33898	0.33333	0.32787	0.32258
0.0400	0.35714	0.35088	0.34483	0.33898	0.33333	0.32787	0.32258
0.0250	0.35714	0.35088	0.34483	0.33898	0.33333	0.32787	0.32258
0.0200	0.35714	0.35088	0.34483	0.33898	0.33333	0.32787	0.32258
0.0100	0.35714	0.35088	0.34483	0.33898	0.33333	0.32787	0.32258
0.0050	0.35714	0.35088	0.34483	0.33898	0.33333	0.32787	0.32258
0.0020	0.35714	0.35088	0.34483	0.33898	0.33333	0.32787	0.32258
0.0010	0.35714	0.35088	0.34483	0.33898	0.33333	0.32787	0.32258
0.0005	0.35714	0.35088	0.34483	0.33898	0.33333	0.32787	0.32258
0.0001	0.35714	0.35088	0.34483	0.33898	0.33333	0.32787	0.32258

P	G = -6.3	G = -6.4	G = -6.5	G = -6.6	G = -6.7	G = -6.8	G = -6.9
0.9999	-16.45487	-16.61875	-16.78156	-16.94329	-17.10397	-17.26361	-17.42221
0.9995	-12.11307	-12.21429	-12.31450	-12.41370	-12.51190	-12.60913	-12.70539
0.9990	-10.30192	-10.37785	-10.45281	-10.52681	-10.59986	-10.67197	-10.74316
0.9980	-8.53820	-8.59027	-8.64142	-8.69167	-8.74102	-8.78950	-8.83711
0.9950	-6.30151	-6.32497	-6.34762	-6.36948	-6.39055	-6.41086	-6.43042
0.9900	-4.70571	-4.71061	-4.71482	-4.71836	-4.72125	-4.72350	-4.72512
0.9800	-3.22484	-3.21497	-3.20460	-3.19374	-3.18241	-3.17062	-3.15838
0.9750	-2.77947	-2.76591	-2.75191	-2.73751	-2.72270	-2.70751	-2.69195
0.9600	-1.90449	-1.88528	-1.86584	-1.84616	-1.82627	-1.80618	-1.78591
0.9500	-1.52434	-1.50365	-1.48281	-1.46186	-1.44079	-1.41963	-1.39839
0.9000	-0.53019	-0.51089	-0.49182	-0.47299	-0.45440	-0.43608	-0.41803
0.8000	0.09469	0.10311	0.11107	0.11859	0.12566	0.13231	0.13853
0.7000	0.26097	0.26146	0.26167	0.26160	0.26128	0.26072	0.25995
0.6000	0.30538	0.30209	0.29875	0.29537	0.29196	0.28854	0.28511
0.5704	0.31016	0.30631	0.30246	0.29862	0.29480	0.29101	0.28726
0.5000	0.31549	0.31090	0.30639	0.30198	0.29766	0.29344	0.28931
0.4296	0.31702	0.31216	0.30743	0.30283	0.29835	0.29400	0.28977
0.4000	0.31724	0.31234	0.30757	0.30294	0.29844	0.29407	0.28982
0.3000	0.31745	0.31249	0.30769	0.30303	0.29850	0.29412	0.28985
0.2000	0.31746	0.31250	0.30769	0.30303	0.29851	0.29412	0.28986
0.1000	0.31746	0.31250	0.30769	0.30303	0.29851	0.29412	0.28986
0.0500	0.31746	0.31250	0.30769	0.30303	0.29851	0.29412	0.28986
0.0400	0.31746	0.31250	0.30769	0.30303	0.29851	0.29412	0.28986
0.0250	0.31746	0.31250	0.30769	0.30303	0.29851	0.29412	0.28986
0.0200	0.31746	0.31250	0.30769	0.30303	0.29851	0.29412	0.28986
0.0100	0.31746	0.31250	0.30769	0.30303	0.29851	0.29412	0.28986
0.0050	0.31746	0.31250	0.30769	0.30303	0.29851	0.29412	0.28986
0.0020	0.31746	0.31250	0.30769	0.30303	0.29851	0.29412	0.28986
0.0010	0.31746	0.31250	0.30769	0.30303	0.29851	0.29412	0.28986
0.0005	0.31746	0.31250	0.30769	0.30303	0.29851	0.29412	0.28986
0.0001	0.31746	0.31250	0.30769	0.30303	0.29851	0.29412	0.28986

P	G =-7.0	G =-7.1	G =-7.2	G =-7.3	G =-7.4	G =-7.5	G =-7.6
0.9999	-17.57979	-17.73636	-17.89193	-18.04652	-18.20013	-18.35278	-18.50447
0.9995	-12.80069	-12.89505	-12.98848	-13.08098	-13.17258	-13.26328	-13.35309
0.9990	-10.81343	-10.88281	-10.95129	-11.01890	-11.08565	-11.15154	-11.21658
0.9980	-8.88387	-8.92979	-8.97488	-9.01915	-9.06261	-9.10528	-9.14717
0.9950	-6.44924	-6.46733	-6.48470	-6.50137	-6.51735	-6.53264	-6.54727
0.9900	-4.72613	-4.72653	-4.72635	-4.72559	-4.72427	-4.72240	-4.71998
0.9800	-3.14572	-3.13263	-3.11914	-3.10525	-3.09099	-3.07636	-3.06137
0.9750	-2.67603	-2.65977	-2.64317	-2.62626	-2.60905	-2.59154	-2.57375
0.9600	-1.76547	-1.74487	-1.72412	-1.70325	-1.68225	-1.66115	-1.63995
0.9500	-1.37708	-1.35571	-1.33430	-1.31287	-1.29141	-1.26995	-1.24850
0.9000	-0.40026	-0.38277	-0.36557	-0.34868	-0.33209	-0.31582	-0.29986
0.8000	0.14434	0.14975	0.15478	0.15942	0.16371	0.16764	0.17123
0.7000	0.25899	0.25785	0.25654	0.25510	0.25352	0.25183	0.25005
0.6000	0.28169	0.27829	0.27491	0.27156	0.26825	0.26497	0.26175
0.5704	0.28355	0.27990	0.27629	0.27274	0.26926	0.26584	0.26248
0.5000	0.28528	0.28135	0.27751	0.27376	0.27010	0.26654	0.26306
0.4296	0.28565	0.28164	0.27774	0.27394	0.27025	0.26665	0.26315
0.4000	0.28569	0.28167	0.27776	0.27396	0.27026	0.26666	0.26315
0.3000	0.28571	0.28169	0.27778	0.27397	0.27027	0.26667	0.26316
0.2000	0.28571	0.28169	0.27778	0.27397	0.27027	0.26667	0.26316
0.1000	0.28571	0.28169	0.27778	0.27397	0.27027	0.26667	0.26316
0.0500	0.28571	0.28169	0.27778	0.27397	0.27027	0.26667	0.26316
0.0400	0.28571	0.28169	0.27778	0.27397	0.27027	0.26667	0.26316
0.0250	0.28571	0.28169	0.27778	0.27397	0.27027	0.26667	0.26316
0.0200	0.28571	0.28169	0.27778	0.27397	0.27027	0.26667	0.26316
0.0100	0.28571	0.28169	0.27778	0.27397	0.27027	0.26667	0.26316
0.0050	0.28571	0.28169	0.27778	0.27397	0.27027	0.26667	0.26316
0.0020	0.28571	0.28169	0.27778	0.27397	0.27027	0.26667	0.26316
0.0010	0.28571	0.28169	0.27778	0.27397	0.27027	0.26667	0.26316
0.0005	0.28571	0.28169	0.27778	0.27397	0.27027	0.26667	0.26316
0.0001	0.28571	0.28169	0.27778	0.27397	0.27027	0.26667	0.26316

P	G = -7.7	G = -7.8	G = -7.9	G = -8.0	G = -8.1	G = -8.2	G = -8.3
0.9999	-18.65522	-18.80504	-18.95393	-19.10191	-19.24898	-19.39517	-19.54046
0.9995	-13.44202	-13.53009	-13.61730	-13.70366	-13.78919	-13.87389	-13.95778
0.9990	-11.28080	-11.34419	-11.40677	-11.46855	-11.52953	-11.58974	-11.64917
0.9980	-9.18828	-9.22863	-9.26823	-9.30709	-9.34521	-9.38262	-9.41931
0.9950	-6.56124	-6.57456	-6.58725	-6.59931	-6.61075	-6.62159	-6.63183
0.9900	-4.71704	-4.71358	-4.70961	-4.70514	-4.70019	-4.69476	-4.68887
0.9800	-3.04604	-3.03038	-3.01439	-2.99810	-2.98150	-2.96462	-2.94746
0.9750	-2.55569	-2.53737	-2.51881	-2.50001	-2.48099	-2.46175	-2.44231
0.9600	-1.61867	-1.59732	-1.57591	-1.55444	-1.53294	-1.51141	-1.48985
0.9500	-1.22706	-1.20565	-1.18427	-1.16295	-1.14168	-1.12048	-1.09936
0.9000	-0.28422	-0.26892	-0.25394	-0.23929	-0.22498	-0.21101	-0.19737
0.8000	0.17450	0.17746	0.18012	0.18249	0.18459	0.18643	0.18803
0.7000	0.24817	0.24622	0.24421	0.24214	0.24003	0.23788	0.23571
0.6000	0.25857	0.25544	0.25236	0.24933	0.24637	0.24345	0.24060
0.5704	0.25919	0.25596	0.25280	0.24970	0.24667	0.24371	0.24081
0.5000	0.25966	0.25635	0.25312	0.24996	0.24689	0.24388	0.24095
0.4296	0.25973	0.25640	0.25316	0.25000	0.24691	0.24390	0.24096
0.4000	0.25974	0.25641	0.25316	0.25000	0.24691	0.24390	0.24096
0.3000	0.25974	0.25641	0.25316	0.25000	0.24691	0.24390	0.24096
0.2000	0.25974	0.25641	0.25316	0.25000	0.24691	0.24390	0.24096
0.1000	0.25974	0.25641	0.25316	0.25000	0.24691	0.24390	0.24096
0.0500	0.25974	0.25641	0.25316	0.25000	0.24691	0.24390	0.24096
0.0400	0.25974	0.25641	0.25316	0.25000	0.24691	0.24390	0.24096
0.0250	0.25974	0.25641	0.25316	0.25000	0.24691	0.24390	0.24096
0.0200	0.25974	0.25641	0.25316	0.25000	0.24691	0.24390	0.24096
0.0100	0.25974	0.25641	0.25316	0.25000	0.24691	0.24390	0.24096
0.0050	0.25974	0.25641	0.25316	0.25000	0.24691	0.24390	0.24096
0.0020	0.25974	0.25641	0.25316	0.25000	0.24691	0.24390	0.24096
0.0010	0.25974	0.25641	0.25316	0.25000	0.24691	0.24390	0.24096
0.0005	0.25974	0.25641	0.25316	0.25000	0.24691	0.24390	0.24096
0.0001	0.25974	0.25641	0.25316	0.25000	0.24691	0.24390	0.24096

P	G = -8.4	G = -8.5	G = -8.6	G = -8.7	G = -8.8	G = -8.9	G = -9.0
0.9999	-19.68489	-19.82845	-19.97115	-20.11300	-20.25402	-20.39420	-20.53356
0.9995	-14.04086	-14.12314	-14.20463	-14.28534	-14.36528	-14.44446	-14.52288
0.9990	-11.70785	-11.76576	-11.82294	-11.87938	-11.93509	-11.99009	-12.04437
0.9980	-9.45530	-9.49060	-9.52521	-9.55915	-9.59243	-9.62504	-9.65701
0.9950	-6.64148	-6.65056	-6.65907	-6.66703	-6.67443	-6.68130	-6.68763
0.9900	-4.68252	-4.67573	-4.66850	-4.66085	-4.65277	-4.64429	-4.63541
0.9800	-2.93002	-2.91234	-2.89440	-2.87622	-2.85782	-2.83919	-2.82035
0.9750	-2.42268	-2.40287	-2.38288	-2.36273	-2.34242	-2.32197	-2.30138
0.9600	-1.46829	-1.44673	-1.42518	-1.40364	-1.38213	-1.36065	-1.33922
0.9500	-1.07832	-1.05738	-1.03654	-1.01581	-0.99519	-0.97471	-0.95435
0.9000	-0.18408	-0.17113	-0.15851	-0.14624	-0.13431	-0.12272	-0.11146
0.8000	0.18939	0.19054	0.19147	0.19221	0.19277	0.19316	0.19338
0.7000	0.23352	0.23132	0.22911	0.22690	0.22469	0.22249	0.22030
0.6000	0.23779	0.23505	0.23236	0.22972	0.22714	0.22461	0.22214
0.5704	0.23797	0.23520	0.23248	0.22982	0.22722	0.22468	0.22219
0.5000	0.23809	0.23528	0.23255	0.22988	0.22727	0.22472	0.22222
0.4296	0.23809	0.23529	0.23256	0.22988	0.22727	0.22472	0.22222
0.4000	0.23810	0.23529	0.23256	0.22988	0.22727	0.22472	0.22222
0.3000	0.23810	0.23529	0.23256	0.22989	0.22727	0.22472	0.22222
0.2000	0.23810	0.23529	0.23256	0.22989	0.22727	0.22472	0.22222
0.1000	0.23810	0.23529	0.23256	0.22989	0.22727	0.22472	0.22222
0.0500	0.23810	0.23529	0.23256	0.22989	0.22727	0.22472	0.22222
0.0400	0.23810	0.23529	0.23256	0.22989	0.22727	0.22472	0.22222
0.0250	0.23810	0.23529	0.23256	0.22989	0.22727	0.22472	0.22222
0.0200	0.23810	0.23529	0.23256	0.22989	0.22727	0.22472	0.22222
0.0100	0.23810	0.23529	0.23256	0.22989	0.22727	0.22472	0.22222
0.0050	0.23810	0.23529	0.23256	0.22989	0.22727	0.22472	0.22222
0.0020	0.23810	0.23529	0.23256	0.22989	0.22727	0.22472	0.22222
0.0010	0.23810	0.23529	0.23256	0.22989	0.22727	0.22472	0.22222
0.0005	0.23810	0.23529	0.23256	0.22989	0.22727	0.22472	0.22222
0.0001	0.23810	0.23529	0.23256	0.22989	0.22727	0.22472	0.22222

OUTLIER TEST K VALUES

10 PERCENT SIGNIFICANCE LEVEL K VALUES

The table below contains one sided 10 percent significance level K_N values for a normal distribution (38). Tests conducted to select the outlier detection procedures used in this report indicate these K_N values are applicable to log-Pearson Type III distributions over the tested range of skew values.

Sample size	K_N value	Sample size	K_N value	Sample size	K_N value	Sample size	K_N value
10	2.036	45	2.727	80	2.940	115	3.064
11	2.088	46	2.736	81	2.945	116	3.067
12	2.134	47	2.744	82	2.949	117	3.070
13	2.175	48	2.753	83	2.953	118	3.073
14	2.213	49	2.760	84	2.957	119	3.075
15	2.247	50	2.768	85	2.961	120	3.078
16	2.279	51	2.775	86	2.966	121	3.081
17	2.309	52	2.783	87	2.970	122	3.083
18	2.335	53	2.790	88	2.973	123	3.086
19	2.361	54	2.798	89	2.977	124	3.089
20	2.385	55	2.804	90	2.981	125	3.092
21	2.408	56	2.811	91	2.984	126	3.095
22	2.429	57	2.818	92	2.989	127	3.097
23	2.448	58	2.824	93	2.993	128	3.100
24	2.467	59	2.831	94	2.996	129	3.102
25	2.486	60	2.837	95	3.000	130	3.104
26	2.502	61	2.842	96	3.003	131	3.107
27	2.519	62	2.849	97	3.006	132	3.109
28	2.534	63	2.854	98	3.011	133	3.112
29	2.549	64	2.860	99	3.014	134	3.114
30	2.563	65	2.866	100	3.017	135	3.116
31	2.577	66	2.871	101	3.021	136	3.119
32	2.591	67	2.877	102	3.024	137	3.122
33	2.604	68	2.883	103	3.027	138	3.124
34	2.616	69	2.888	104	3.030	139	3.126
35	2.628	70	2.893	105	3.033	140	3.129
36	2.639	71	2.897	106	3.037	141	3.131
37	2.650	72	2.903	107	3.040	142	3.133
38	2.661	73	2.908	108	3.043	143	3.135
39	2.671	74	2.912	109	3.046	144	3.138
40	2.682	75	2.917	110	3.049	145	3.140
41	2.692	76	2.922	111	3.052	146	3.142
42	2.700	77	2.927	112	3.055	147	3.144
43	2.710	78	2.931	113	3.058	148	3.146
44	2.719	79	2.935	114	3.061	149	3.148

CONDITIONAL PROBABILITY ADJUSTMENT

For stations where the record of annual peaks is truncated by the omission of peaks below a gage base, years with zero flow, and/or low outlier criterion, the conditional probability adjustment described in reference (28) is recommended to obtain the frequency curve. These procedures should only be used when not over 25 percent of the total record has been truncated. A truncation level is defined as the minimum discharge that will exclude peaks below the gage base, zero flows, all low outliers, and no other discharges. Because data from stations treated by this procedure may not fit a log-Pearson Type III distribution, any computed frequency curve should be compared with a plot of observed values.

Prior to applying the conditional probability adjustment, the data should have been reviewed and the statistics for the above gage-base peaks computed. Procedures for detecting outliers, recomputing statistics for peaks above the truncation level, and incorporating applicable historic information should have been completed. All except the last computation step shown on the flow chart in Appendix 12 (page 12-3) should have been completed. The steps in the conditional probability adjustment are as follows:

1. Calculate the estimated probability \widetilde{P} that any annual peak will exceed the truncation level by the formula:

$$\widetilde{P} = \frac{N}{n} \quad (5-1a)$$

in which N is the number of peaks above the truncation level and n is the total number of years of record. If historic information has been included, then equation 5-1b should be used rather than 5-1a. *

*

$$\tilde{P} = \frac{H-WL}{H} \quad (5-1b)$$

where H is the historic record length, L the number of peaks truncated and W the systematic record weight as computed in Appendix 6, equation 6-1.

2. Recompute the exceedance probabilities, P, for selected points, P_d , on the frequency curve using equation 5-2:

$$P = \tilde{P} \times P_d \quad (5-2)$$

This accounts for the omission of peaks below the truncation level.

3. The exceedance probabilities, P, computed by equation 5-2 are usually not those needed to compute the synthetic sample statistics. Therefore, it is necessary to interpolate either graphically or mathematically to obtain log discharge values for the 0.01, 0.10, and 0.50 exceedance probabilities.

4. Since the conditional probability adjusted frequency curve does not have known statistics, synthetic ones will be computed. These synthetic statistics will be determined based on the values for the three exceedance probabilities determined in step 3, using the following equations.

$$G_s = -2.50 + 3.12 \frac{\text{Log}(Q_{.01}/Q_{.10})}{\text{Log}(Q_{.10}/Q_{.50})} \quad (5-3)$$

$$S_s = \frac{\text{Log}(Q_{.01}/Q_{.50})}{K_{.01} - K_{.50}} \quad (5-4)$$

$$\bar{X}_s = \text{Log}(Q_{.50}) - K_{.50}(S_s) \quad (5-5)$$

where G_s , S_s , and \bar{X}_s are the synthetic logarithmic skew coefficient, standard deviation, and mean, respectively; $Q_{.01}$, $Q_{.10}$, and $Q_{.50}$ are discharges

* with 0.01, and 0.10, and 0.50 exceedance probabilities respectively; and $K_{.01}$ and $K_{.50}$ are Pearson Type III deviates for exceedance probabilities of 0.01 and 0.50 respectively, and skew coefficient G_s . Equation 5-3 is an approximation appropriate for use between skew values of +2.5 and -2.0.

5. The frequency curve developed from the synthetic statistics should be compared with the observed annual peak discharges. The plotting position should be based upon the total number of years record, n or H , as appropriate.

The minimum additional requirement to arrive at a final frequency curve is the determination of the weighted skew. Examples 3 and 4 of Appendix 12 illustrate the basic steps in computing a frequency curve using the conditional probability adjustment. Other considerations in a complete analysis might include two-station comparison, use of rainfall data, or other techniques described in this report. *

NOTATION

G_s	= synthetic logarithmic skew coefficient
H	= historic record length
$K_{.01}, K_{.50}$	= Pearson type III deviate from Appendix 3 for exceedance probabilities of 0.01 and 0.50 respectively, and skew coefficient G_s .
L	= number of peaks truncated
N	= number of peaks above the truncation level
n	= total number of years of record
P	= exceedance probabilities
\tilde{P}	= estimated probability that an annual peak will exceed the truncation level.
P_d	= selected points on the frequency curve
$Q_{.01}, Q_{.10}, Q_{.50}$	= discharges with exceedance probabilities of 0.01, 0.10, and 0.50, respectively
S_s	= synthetic logarithmic standard deviation
W	= systematic record weight from Appendix 6
\bar{X}_s	= synthetic logarithmic mean

*

Appendix 6
HISTORIC DATA

+ Flood information outside that in the systematic record can often be used to extend the record of the largest events to a historic period much longer than that of the systematic record. In such a situation, the following analytical techniques are used to compute a historically adjusted log-Pearson Type III frequency curve. +

1. Historic knowledge is used to define the historically longer period of "H" years. The number "Z" of events that are known to be the largest in the historically longer period "H" are given a weight of 1.0. The remaining "N" events from the systematic record are given a weight of $(H-Z)/(N+L)$ on the assumption that their distribution is representative of the (H-Z) remaining years of the historically longer period. *

2. The computations can be done directly by applying the weights to each individual year's data using equations 6-1, 6-2a, 6-3a, and 6-4a.

+ Figure 6-1 is an example of this procedure in which there are 44 years of systematic record and the 1897, 1919 and 1927 floods are known to be the three largest floods in the 77 year period 1897 to 1973. If statistics have been previously computed for the current continuous record, they can be adjusted to give the equivalent historically adjusted values using equations 6-1, 6-2b, 6-3b, and 6-4b, as illustrated in Figure 6-2. +

+ 3. The historically adjusted frequency curve is sketched on logarithmic-probability paper through points established by use of equation 6-5. The individual flood events should also be plotted for comparison. The historically adjusted plotting positions for the individual flood events are computed by use of equation 6-8, in which the historically adjusted order number of each event "m" is computed from equations 6-6 and 6-7. The computations are illustrated in Figures 6-1 and 6-2, and the completed plotting is shown in Figure 6-3. *

+ 4. The following example illustrates the steps in application of the historic peak adjustment only. It does not include the final step of weighting with the generalized skew. The historically adjusted skew developed by this procedure is appropriate to use in developing a generalized skew. +

DEFINITION OF SYMBOLS

- E = event number when events are ranked in order from greatest magnitude to smallest magnitude. The event numbers "E" will range from 1 to (Z + N).
- + X = logarithmic magnitude of systematic peaks excluding zero flood events, peaks below base, high or low outliers
- X_Z = logarithmic magnitude of a historic peak including a high outlier that has historic information
- N = number of X's +
- + M = mean of X's
- \tilde{M} = historically adjusted mean
- \tilde{m} = historically adjusted order number of each event for use in formulas to compute the plotting position on probability paper +
- S = standard deviation of the X's
- \tilde{S} = historically adjusted standard deviation +
- G = skew coefficient of the X's
- + \tilde{G} = historically adjusted skew coefficient +
- K = Pearson Type III coordinate expressed in number of standard deviations from the mean for a specified recurrence interval or percent chance
- Q = computed flood flow for a selected recurrence interval or percent chance
- \tilde{P} = plotting position in percent
- * \tilde{P} = probability that any peak will exceed the truncation level (used in step 1, Appendix 5) *
- + Z = number of historic peaks including high outliers that have historic information +
- * H = number of years in historic period *
- + L = number of low values to be excluded, such as: number of zeros, number of incomplete record years (below measurable base), and low outliers which have been identified +
- * a = constant that is characteristic of a given plotting position formula. For Weibull formula, a = 0; for Beard formula, a = 0.3; and for Hazen formula, a = 0.5 *
- * W = systematic record weight *

EQUATIONS

$$+ W = \frac{H - Z}{N + L} \quad (6-1)$$

$$\tilde{M} = \frac{W \sum X + \sum X_Z}{H - WL} \quad (6-2a)$$

$$\tilde{S}^2 = \frac{W \sum (X - \tilde{M})^2 + \sum (X_Z - \tilde{M})^2}{(H - WL - 1)} \quad (6-3a)$$

$$\tilde{G} = \frac{H - WL}{(H - WL - 1)(H - WL - 2)} \left[\frac{W \sum (X - \tilde{M})^3 + \sum (X_Z - \tilde{M})^3}{\tilde{S}^3} \right] \quad (6-4a)$$

$$\tilde{M} = \frac{WNM + \sum X_Z}{H - WL} \quad (6-2b)$$

$$\tilde{S}^2 = \frac{W(N - 1)S^2 + WN(M - \tilde{M})^2 + \sum (X_Z - \tilde{M})^2}{(H - WL - 1)} \quad (6-3b)$$

$$\tilde{G} = \frac{H - WL}{(H - WL - 1)(H - WL - 2)\tilde{S}^3} \left[\frac{W(N - 1)(N - 2)S^3 G}{N} + 3W(N - 1)(M - \tilde{M})S^2 + WN(M - \tilde{M})^3 + \sum (X_Z - \tilde{M})^3 \right] \quad (6-4b) \quad +$$

$$* \text{Log } Q = \tilde{M} + K\tilde{S} \quad (6-5)$$

$$\tilde{m} = E; \text{ when: } 1 \leq E \leq Z \quad (6-6) \quad *$$

$$+ \tilde{m} = WE - (W - 1)(Z + 0.5); \text{ when: } (Z + 1) \leq E \leq (Z + N + L) \quad (6-7) \quad +$$

$$P\tilde{P} = \frac{\tilde{m} - a}{H + 1 - 2a} 100 \quad (6-8)$$

* Figure 6-1. HISTORICALLY WEIGHTED LOG PEARSON-TYPE III - ANNUAL PEAKS (Continued)

Solving (Eq. 6-2a)

$$\begin{aligned}\Sigma X &= 162.40155 \\ W \Sigma X &= 273.13018 \\ \Sigma X_z &= \frac{12.98733}{286.11751}\end{aligned}$$

$$\bar{M} = 286.11751/77 = \underline{3.71581}$$

Solving (Eq. 6-3a)

$$\begin{aligned}\Sigma x^2 &= 3.09755 \\ W \Sigma x^2 &= 5.20952 \\ \Sigma x_z^2 &= \frac{1.13705}{6.34657}\end{aligned}$$

$$\bar{S}^2 = 6.34657/(77 - 1) = 0.08351$$

$$\bar{S} = \underline{0.28898} \quad \bar{S}^3 = 0.02413$$

Solving (Eq. 6-4a)

$$\begin{aligned}\Sigma x^3 &= -0.37648 \\ W \Sigma x^3 &= -0.63317 \\ \Sigma x_z^3 &= \frac{0.70802}{0.07485}\end{aligned}$$

$$\bar{G} = \frac{(77)(0.07485)}{(76)(75)(0.02413)} = \underline{0.0418}$$

Solving (Eq. 6, Page 13)

$$\begin{aligned}N &= 77 \\ A &= -0.33 + 0.08(0.0418) = -0.32666 \\ B &= 0.94 - 0.26(0.0418) = 0.92913\end{aligned}$$

$$MSE_G = 10^{-0.32666 - 0.92913[0.88649]} = 10^{-1.150325} = 0.07074$$

Solving (Eq. 9.5, Page 12)

$$G_w = \frac{0.302(0.0418) + 0.07074(-0.2)}{.302 + 0.07074} = -0.00409$$

Solving (Eq. 6-5)

%	K $G_w = -0.00409$	$\bar{S}(S)(K)$ $\bar{S} = .28898$	$\bar{M} + (\bar{S})(K) = \text{Log } Q$ $\bar{M} = 3.71581$	Q (ft ³ /s)
99	-2.32934	-0.67313	3.04269	1,103
95	-1.64599	-0.47566	3.24014	1,738
90	-1.28196	-0.37046	3.34535	2,215
80	-0.84141	-0.24315	3.47266	2,969
50	0.00067	0.00019	3.71600	5,200
20	0.84180	0.24326	3.95907	9,100
10	1.28110	0.37021	4.08602	12,190
4	1.74929	0.50551	4.22132	16,646
2	2.05159	0.59289	4.30868	20,355
1	2.32340	0.67142	4.38723	24,391
.1	3.08455	0.89138	4.60719	40,475
.01	3.71054	1.07227	4.78808	61,387

Solving (Eq. 6-6)

$$\begin{aligned}Z &= 3 \\ \text{For } E = 1; \bar{m} &= E = 1 \\ \text{For } E = 2; \bar{m} &= E = 2 \\ \text{For } E = 3; \bar{m} &= E = 3\end{aligned}$$

Solving (Eq. 6-8)

$$\text{For Weibull: } a = 0. \bar{P}P = (100)(\bar{m})/(78)$$

Solving (Eq. 6-7)

$$\begin{aligned}(Z + 1) &= 4 \\ (Z + N) &= 47 \\ \text{For } 4 \leq E \leq 47: \\ \bar{m} &= (1.682)(E) - (0.682)(3.5) \\ \bar{m} &= (1.682)(E) - 2.387\end{aligned}$$



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Figure 6-2. HISTORICALLY WEIGHTED LOG-PEARSON TYPE III - ANNUAL PEAKS

Results of Standard Computation for the Current Continuous Record

Big Sandy River at Bruceton, TN. DA - 205 square miles
 #3-6065 (44 years)

- N = number of observations used = 44
- M = mean of logarithms = 3.69094
- S = standard deviation of logarithms = 0.26721
- S² = 0.07140 S³ = 0.01908
- G = coefficient of skewness (logs) = -0.18746

Adjustment to Historically Weighted 77 Years

Historic Peaks (Z = 3 Years)					
Year	Y _Z (ft ³ /s)	Log Y _Z = X _Z	X _Z - \tilde{M}	(X _Z - \tilde{M}) ²	(X _Z - \tilde{M}) ³
1897	25,000	4.39794	0.68213	0.46531	0.31740
1919	21,000	4.32222	0.60641	0.36774	0.22300
1927	18,500	4.26717	0.55136	0.30400	0.16762
Summation		12.98733	1.83990	1.13705	0.70802

N = 44 Z = 3 H = 77

Solving (Eq. 6-1): W = (77-3)/44 = 1.68182

Solving (Eq. 6-2b): $\tilde{M} = \frac{(1.68182)(44)(3.69094) + (12.98733)}{77} = 3.71581$

Solving (Eq. 6-3b):

(M - \tilde{M}) = -0.02487; (M - \tilde{M})² = 0.000619; (M - \tilde{M})³ = -0.0000154

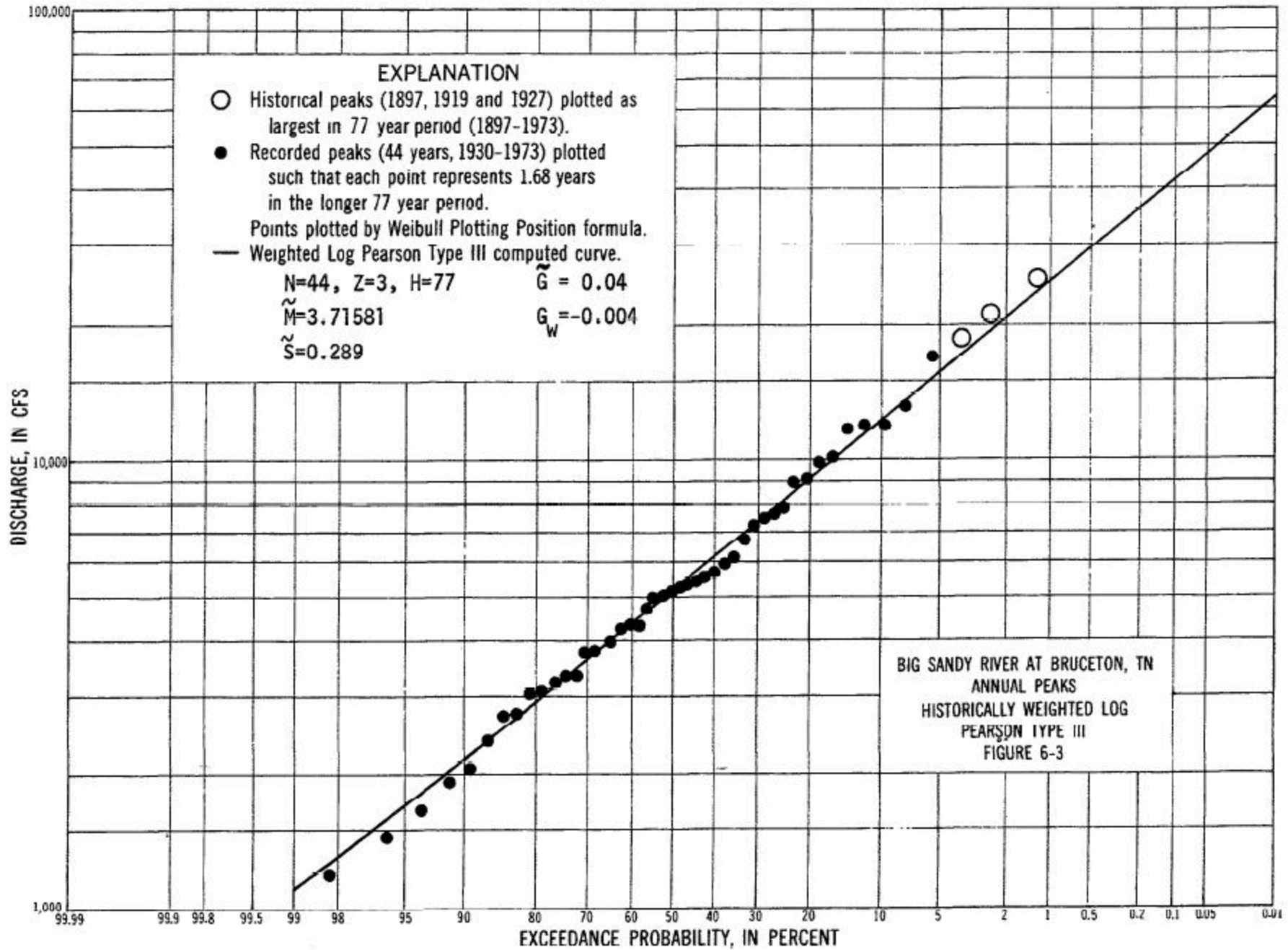
$\tilde{S}^2 = \frac{(1.68182)(43)(0.07140) + (1.68182)(44)(0.000619) + (1.13705)}{76} = 0.08351$

$\tilde{S}^2 = 0.08351$ $\tilde{S} = 0.28898$ $\tilde{S}^3 = 0.02413$

Solving (Eq. 6-4b):

$\tilde{G} = \frac{77}{(76)(75)(0.02413)} \left[\frac{(1.68182)(43)(42)(0.01908)(-0.18746)}{44} + (3)(1.68182)(43)(-0.02487)(0.07140) + (1.68182)(44)(-0.0000154) + (0.70802) \right]$
 $\tilde{G} = 0.0418$

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Appendix 7

TWO STATION COMPARISON

INTRODUCTION

The procedure outlined herein is recommended for use in adjusting the logarithmic mean and standard deviation of a short record on the basis of a regression analysis with a nearby long-term record. The theoretical basis for the equations provided herein were developed by Matalas and Jacobs (29).

The first step of the procedure is to correlate observed peak flows for the short record with concurrent observed peak flows for the long record. The regression and correlation coefficients, respectively, can be computed by the following two equations:

$$b = \frac{\sum X_1 Y_1 - \sum X_1 \sum Y_1 / N_1}{\sum X_1^2 - (\sum X_1)^2 / N_1} \quad (7-1)$$

$$r = b \frac{S_{x_1}}{S_{y_1}} \quad (7-2)$$

where the terms are defined at the end of this Appendix.

If the correlation coefficient defined by equation 7-2 meets certain criteria, then improved estimates of the short record mean and standard deviation can be made. Both of these statistics can be improved when the variance of that statistic is reduced. As each statistic is evaluated separately, only one adjustment may be worthwhile. The criterion and adjustment procedure for each statistic are discussed separately. In each discussion, two cases are considered: (1) entire short record contained in the long record, (2) only part of the short record contained in the long record. The steps for case 2 include all of those for case 1 plus an additional one.

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CRITERION AND ADJUSTMENT PROCEDURE FOR MEAN

The variance of the adjusted mean (\bar{Y}) can be determined by equation 7-3:

$$\text{Var}(\bar{Y}) = \frac{(s_{y_1})^2}{N_1} \left[1 - \frac{N_2}{N_1 + N_2} \left(r^2 - \frac{(1-r^2)}{(N_1-3)} \right) \right] \quad (7-3)$$

Since $(s_{y_1})^2/N_1$ is the variance of \bar{Y}_1 , the short-record mean, \bar{Y} will be

a better estimate of the true mean than \bar{Y}_1 if the term $r^2 - \frac{1-r^2}{N_1-3}$ in

equation 7-3 is positive. Solving this relationship for r yields equation 7-4. If the correlation coefficient satisfies equation 7-4,

$$r > 1/(N_1 - 2)^{1/2} \quad (7-4)$$

then an adjustment to the mean is worthwhile. The right side of this inequality represents the minimum critical value of r . Table 7-1 contains minimum critical values of r for various values of N_1 . The adjusted logarithmic mean can be computed using equation 7-5a or 7-5b.

$$\bar{Y} = \bar{Y}_1 + \frac{N_2}{N_1 + N_2} \left[b (\bar{X}_2 - \bar{X}_1) \right] \quad (7-5a)$$

$$\bar{Y} = \bar{Y}_1 + b(\bar{X}_3 - \bar{X}_1) \quad (7-5b)$$

Equation 7-5b saves recomputing a new \bar{X}_2 at the long record station for each short record station that is being correlated with the long record station. While the adjusted mean from equation 7-5a or 7-5b may be an improved estimate of the mean obtained from the concurrent period, it may not be an improvement over the entire short record mean in case 2. It is necessary to compare the variance of the adjusted mean (equation 7-3) to the variance of the mean (\bar{Y}_3) for the entire short record period (N_3). Compute the variance of the mean \bar{Y}_3 using equation 7-6:

$$\text{Var}(\bar{Y}_3) = \frac{(s_{y_3})^2}{N_3} \quad (7-6) *$$

*

where S_{y_3} is the standard deviation of the logarithms of flows for the short record site for the period N_3 . If the variance of equation 7-6 is smaller than the variance of \bar{Y} given in equation 7-3, then use \bar{Y}_3 as the final estimate of the mean. Otherwise, use the value of \bar{Y} computed in equation 7-5a or 7-5b.

EQUIVALENT YEARS OF RECORD FOR THE MEAN

As illustrated in equations 7-3 and 7-6, the variance of the mean is inversely proportional to the record length at the site. Using equation 7-3 it can be shown that the equivalent years of record, N_e , for the adjusted mean is:

$$N_e = \frac{N_1}{1 - \frac{N_2}{N_1 + N_2} \left(r^2 - \frac{(1-r^2)}{(N_1-3)} \right)} \quad (7-7)$$

It may be seen from equation 7-7 that when there is no correlation ($r=0$), then N_e is less than N_1 . This indicates that the correlation technique can actually decrease the equivalent years of record unless r satisfies equation 7-4. For perfect correlation ($r=1$), then $N_e = N_1 + N_2$, the total record length at the long record site.

Although N_e is actually the equivalent years of record for the mean, it is recommended that N_e be used as an estimate of the equivalent years of record for the various exceedance probability floods in the computation of confidence limits and in applying the expected probability adjustment.

CRITERION AND ADJUSTMENT PROCEDURE FOR THE STANDARD DEVIATION

The variance of the adjusted variance S_y^2 (square of the standard deviation) can be determined by equation 7-8:

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$$\text{Var}(S_y^2) = \frac{2(S_{y_1})^4}{N_1-1} + \frac{N_2(S_{y_1})^4}{(N_1+N_2-1)^2} [Ar^4 + Br^2 + C] \quad (7-8)$$

where A, B, and C are defined below and the other terms are defined at the end of the appendix. In equation 7-8, $2(S_{y_1})^4/(N_1-1)$ is the variance of $S_{y_1}^2$ (the short-record variance). If the second term in equation 7-8 is negative, then the variance of S_y^2 will be less than the variance of $S_{y_1}^2$. Solving this relationship for r yields the following equation:

$$|r| > \left[\frac{-B \pm \sqrt{B^2 - 4AC}}{2A} \right]^{1/2} \quad (7-9)$$

where

$$A = \frac{(N_2+2)(N_1-6)(N_1-8)}{(N_1-3)(N_1-5)} - \frac{8(N_1-4)}{(N_1-3)} - \frac{2N_2(N_1-4)^2}{(N_1-3)^2} + \frac{N_1N_2(N_1-4)^2}{(N_1-3)^2(N_1-2)} + \frac{4(N_1-4)}{(N_1-3)}$$

$$B = \frac{6(N_2+2)(N_1-6)}{(N_1-3)(N_1-5)} + \frac{2(N_1^2 - N_1 - 14)}{(N_1-3)} + \frac{2N_2(N_1-4)(N_1-5)}{(N_1-3)^2} - \frac{2(N_1-4)(N_1+3)}{(N_1-3)} - \frac{2N_1N_2(N_1-4)^2}{(N_1-3)^2(N_1-2)}$$

$$C = \frac{2(N_1+1)}{N_1-3} + \frac{3(N_2+2)}{(N_1-3)(N_1-5)} - \frac{(N_1+1)(2N_1+N_2-2)}{N_1-1} + \frac{2N_2(N_1-4)}{(N_1-3)^2} + \frac{2(N_1-4)(N_1+1)}{(N_1-3)} + \frac{N_1N_2(N_1-4)^2}{(N_1-3)^2(N_1-2)}$$

*

* The right side of the inequality (7-9) represents the minimum critical value of r . Table 7-1 gives approximate minimum critical values of r for various values of N_1 . The table values are an approximation as they are solutions of equation 7-9 for a constant N_2 . The variations in N_2 only affect the table values slightly.

If the correlation coefficient satisfies equation 7-9, then the adjusted variance can be computed by equation 7-10:

$$S_y^2 = \frac{1}{(N_1+N_2-1)} \left[(N_1-1)S_{y_1}^2 + (N_2-1)b^2S_{x_2}^2 + \frac{N_2(N_1-4)(N_1-1)}{(N_1-3)(N_1-2)} (1-r^2)S_{y_1}^2 + \frac{N_1N_2}{N_1+N_2} b^2 (\bar{X}_2 - \bar{X}_1)^2 \right] \quad (7-10)$$

The adjusted standard deviation S_y equals the square root of the adjusted variance in equation 7-10. The third term in brackets in equation 7-10 is an adjustment factor to give an unbiased estimate of S_y^2 . This adjustment is equivalent to adding random noise to each estimated value of flow at the short-term site.

While the adjusted variance from equation 7-10 may be an improved estimate of the variance (standard deviation) obtained from the concurrent period, it may not be an improvement over the entire short record variance (standard deviation) in case 2. It is necessary to compare the variance of the adjusted variance (equation 7-8) to the variance of the variance ($S_{y_3}^2$) for the entire period (N_3). Compute the variance of the short-record variance ($S_{y_3}^2$) using equation 7-11.

$$\text{Var} \left(S_{y_3}^2 \right) = \frac{2 \left(S_{y_3} \right)^4}{N_3 - 1} \quad (7-11)$$

*

where all terms are previously defined. If the variance of equation 7-11 is smaller than the variance of S_y^2 given in equation 7-8, then use S_{y_3} as the final estimate of the standard deviation. Otherwise, use the value of S_y determined from equation 7-10.

FURTHER CONSIDERATIONS

The above equations were developed under the assumption that the concurrent observations of flows at the short and long-term sites have a joint normal probability distribution with a skewness of zero. When this assumption is seriously violated, the above equations are not exact and this technique should be used with caution. In addition, the reliability of r depends on the length of the concurrent period, N_1 . To obtain a reliable estimate of r , N_1 should be at least 10 years.

Notice that it is not necessary to estimate the actual annual peaks from the regression equation but only the adjusted logarithmic mean and standard deviation. The adjusted skew coefficient should be computed by weighting the generalized skew with the skew computed from the short record site as described in Section V.B.4.

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NOTATION

N_1 = Number of years when flows were concurrently observed at the two sites

N_2 = Number of years when flows were observed at the longer record site but not observed at the short record site

N_3 = Number of years of flow at the short record site

N_e = Equivalent years of record of the adjusted mean

S_y = Standard deviation of the logarithm of flows for the extended period at the short record site

S_{x_1} = Standard deviation of logarithm of flows at the long record site during concurrent period

S_{x_2} = Standard deviation of logarithm of flows at the long record site for the period when flows were not observed at the short record site

S_{y_1} = Standard deviation of the logarithm of flows at the short record site for the concurrent period

S_{y_2} = not used

S_{y_3} = Standard deviation of logarithm of flows for the entire period at the short record site

X_1 = Logarithms of flows from long record during concurrent period

\bar{X}_1 = Mean logarithm of flows at the long record site for the concurrent period

\bar{X}_2 = Mean logarithm of flows at the long record site for the period when flow records are not available at the short record site

\bar{X}_3 = Mean logarithm of flows for the entire period at the long record site

Y_1 = Logarithms of flows from short record during concurrent period

\bar{Y} = Mean logarithm of flows for the extended period at the short record site

\bar{Y}_1 = Mean logarithm of flows for the period of observed flow at the short record site (concurrent period)

\bar{Y}_2 = not used

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\bar{Y}_3 = Mean logarithm of flows for the entire period at the short record site

b = Regression coefficient for Y_1 on X_1

r = Correlation coefficient of the flows at the two sites for concurrent periods

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TABLE 7-1 MINIMUM r VALUES FOR IMPROVING
MEAN OR STANDARD DEVIATION ESTIMATES

CONCURRENT RECORD	MEAN	STANDARD DEVIATION
10	0.35	0.65
11	0.33	0.62
12	0.32	0.59
13	0.30	0.57
14	0.29	0.55
15	0.28	0.54
16	0.27	0.52
17	0.26	0.50
18	0.25	0.49
19	0.24	0.48
20	0.24	0.47
21	0.23	0.46
22	0.22	0.45
23	0.22	0.44
24	0.21	0.43
25	0.21	0.42
26	0.20	0.41
27	0.20	0.41
28	0.20	0.40
29	0.19	0.39
30	0.19	0.39
31	0.19	0.38
32	0.18	0.37
33	0.18	0.37
34	0.18	0.36
35	0.17	0.36

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