

## 二変数ガンマ分布とその適用に関する研究 (3)

——二変数指数分布の数値表——

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### STUDY ON TWO-VARIATE GAMMA DISTRIBUTION AND ITS ENGINEERING APPLICATION (3)

——Numerical Table of Two-Variate Exponential Distribution——

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#### Synopsis

By using the theory of two-variate exponential distribution, the conditional probability function,  $f(x_2|x_1)$ , of  $x_2$  for a fixed value,  $x_1$ , is given as follows:

$$f(x_2|x_1) = \frac{1}{\sigma_2(1-\rho)} \exp\left\{-\frac{\rho x_1}{\sigma_1(1-\rho)} - \frac{x_2}{\sigma_2(1-\rho)}\right\} \cdot I_0\left(\frac{2\sqrt{\rho}}{1-\rho} \sqrt{\frac{x_1 x_2}{\sigma_1 \sigma_2}}\right)$$

in which  $\sigma_1$  and  $\sigma_2$  are scale parameters;  $\rho$  is correlation parameter; and  $I_0(z)$  means the modified Bessel function of the 0 degree. Then, using the standardized variables  $\xi = x_1/\sigma_1$  and  $\eta = x_2/\sigma_2$ , the conditional cumulative distribution function,  $F(\eta|\xi)$ , for a fixed value of  $\xi$  is defined by the following.

$$F(\eta|\xi) \equiv \int_0^\eta f(\eta|\xi) d\eta = \frac{1}{1-\rho} \exp\left(-\frac{\rho\xi}{1-\rho}\right) \int_0^\eta \exp\left(-\frac{\eta}{1-\rho}\right) \cdot I_0\left(\frac{2\sqrt{\rho}}{1-\rho} \sqrt{\xi\eta}\right) d\eta$$

In this table, the value of  $\eta$  has been shown for  $F(\eta|\xi) = 0.001(0.001)0.01(0.01)0.20(0.05)0.80(0.01)0.99(0.001)0.999$ ,  $\xi = 0(0.25)3.00(0.5)5(1)10(2)18$  and  $\rho = 0.1(0.1)0.9$ . In it, for example, the numerical values  $0.1234-1$  means  $0.1234 \times 10^{-1}$ .

二変数  $x_1, x_2$  に関する二変数指数分布の理論によれば標準化変量  $\xi = x_1/\sigma_1, \eta = x_2/\sigma_2$  を用いた場合、独立変数  $\xi$  を与えたときの従属変数  $\eta$  の条件付非超過確率  $F(\eta|\xi)$  は次式で与えられる。

$$F(\eta|\xi) \equiv \int_0^\eta f(\eta|\xi) d\eta \\ = \int_0^\eta \frac{1}{1-\rho} \exp\left(-\frac{\rho\xi + \eta}{1-\rho}\right) \cdot I_0\left(\frac{2\sqrt{\rho}}{1-\rho} \sqrt{\xi\eta}\right) d\eta$$

ただし、 $\sigma_1, \sigma_2$  は尺度母数、 $\rho$  は相関母数とよばれる定数であり、 $I_0(z)$  は 0 次の変形ベッセル関数である。 $\rho, \xi$  および  $\eta$  の種々の値に対する  $F(\eta|\xi)$  の値は数表として第 1 報で準備されたが、今回さらに実用計算上の便宜を考えて、それを  $\xi$  および  $F$  を与えて  $\eta$  を求める形に整理したものが **Table 1-(a), 1-(b), …, 9-(a), 9-(b)** である。なお、数表中において、たとえば数値  $0.1234-1$  は  $0.1234 \times 10^{-1}$  を意味している。

Table 1-(a) Values of  $\eta$  for  $F(\eta|\xi)$  and  $\xi_i$  for  $\rho=0.1$ .

$F(\eta \xi)$	0.00	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	
0.001	0.008	-3	0.919	-3	0.098	-2	0.104	-2	0.108	-2	0.112	-2	0.116	-2
0.002	0.016	-2	0.938	-2	0.106	-2	0.110	-2	0.114	-2	0.118	-2	0.122	-2
0.003	0.024	-2	0.957	-2	0.108	-2	0.112	-2	0.116	-2	0.120	-2	0.124	-2
0.004	0.032	-2	0.976	-2	0.110	-2	0.114	-2	0.118	-2	0.122	-2	0.126	-2
0.005	0.040	-2	0.995	-2	0.112	-2	0.116	-2	0.120	-2	0.124	-2	0.128	-2
0.006	0.048	-2	1.014	-2	0.114	-2	0.118	-2	0.122	-2	0.126	-2	0.130	-2
0.007	0.056	-2	1.033	-2	0.116	-2	0.120	-2	0.124	-2	0.128	-2	0.132	-2
0.008	0.064	-2	1.052	-2	0.118	-2	0.122	-2	0.126	-2	0.130	-2	0.134	-2
0.009	0.072	-2	1.071	-2	0.120	-2	0.124	-2	0.128	-2	0.132	-2	0.136	-2
0.01	0.080	-2	1.090	-2	0.122	-2	0.126	-2	0.130	-2	0.134	-2	0.138	-2
0.02	0.160	-1	1.180	-1	0.132	-1	0.136	-1	0.140	-1	0.144	-1	0.148	-1
0.03	0.240	-1	1.270	-1	0.142	-1	0.146	-1	0.150	-1	0.154	-1	0.158	-1
0.04	0.320	-1	1.360	-1	0.152	-1	0.156	-1	0.160	-1	0.164	-1	0.168	-1
0.05	0.400	-1	1.450	-1	0.162	-1	0.166	-1	0.170	-1	0.174	-1	0.178	-1
0.06	0.480	-1	1.540	-1	0.172	-1	0.176	-1	0.180	-1	0.184	-1	0.188	-1
0.07	0.560	-1	1.630	-1	0.182	-1	0.186	-1	0.190	-1	0.194	-1	0.198	-1
0.08	0.640	-1	1.720	-1	0.192	-1	0.196	-1	0.200	-1	0.204	-1	0.208	-1
0.09	0.720	-1	1.810	-1	0.202	-1	0.206	-1	0.210	-1	0.214	-1	0.218	-1
0.10	0.800	-1	1.900	-1	0.212	-1	0.216	-1	0.220	-1	0.224	-1	0.228	-1
0.11	0.880	-1	1.990	-1	0.222	-1	0.226	-1	0.230	-1	0.234	-1	0.238	-1
0.12	0.960	-1	2.080	-1	0.232	-1	0.236	-1	0.240	-1	0.244	-1	0.248	-1
0.13	1.040	-1	2.170	-1	0.242	-1	0.246	-1	0.250	-1	0.254	-1	0.258	-1
0.14	1.120	-1	2.260	-1	0.252	-1	0.256	-1	0.260	-1	0.264	-1	0.268	-1
0.15	1.200	-1	2.350	-1	0.262	-1	0.266	-1	0.270	-1	0.274	-1	0.278	-1
0.16	1.280	-1	2.440	-1	0.272	-1	0.276	-1	0.280	-1	0.284	-1	0.288	-1
0.17	1.360	-1	2.530	-1	0.282	-1	0.286	-1	0.290	-1	0.294	-1	0.298	-1
0.18	1.440	-1	2.620	-1	0.292	-1	0.296	-1	0.300	-1	0.304	-1	0.308	-1
0.19	1.520	-1	2.710	-1	0.302	-1	0.306	-1	0.310	-1	0.314	-1	0.318	-1
0.20	1.600	-1	2.800	-1	0.312	-1	0.316	-1	0.320	-1	0.324	-1	0.328	-1
0.25	2.000	-1	3.200	-1	0.362	-1	0.366	-1	0.370	-1	0.374	-1	0.378	-1
0.30	2.400	-1	3.600	-1	0.412	-1	0.416	-1	0.420	-1	0.424	-1	0.428	-1
0.35	2.800	-1	4.000	-1	0.462	-1	0.466	-1	0.470	-1	0.474	-1	0.478	-1
0.40	3.200	-1	4.400	-1	0.512	-1	0.516	-1	0.520	-1	0.524	-1	0.528	-1
0.45	3.600	-1	4.800	-1	0.562	-1	0.566	-1	0.570	-1	0.574	-1	0.578	-1
0.50	4.000	-1	5.200	-1	0.612	-1	0.616	-1	0.620	-1	0.624	-1	0.628	-1
0.55	4.400	-1	5.600	-1	0.662	-1	0.666	-1	0.670	-1	0.674	-1	0.678	-1
0.60	4.800	-1	6.000	-1	0.712	-1	0.716	-1	0.720	-1	0.724	-1	0.728	-1
0.65	5.200	-1	6.400	-1	0.762	-1	0.766	-1	0.770	-1	0.774	-1	0.778	-1
0.70	5.600	-1	6.800	-1	0.812	-1	0.816	-1	0.820	-1	0.824	-1	0.828	-1
0.75	6.000	-1	7.200	-1	0.862	-1	0.866	-1	0.870	-1	0.874	-1	0.878	-1
0.80	6.400	-1	7.600	-1	0.912	-1	0.916	-1	0.920	-1	0.924	-1	0.928	-1
0.85	6.800	-1	8.000	-1	0.962	-1	0.966	-1	0.970	-1	0.974	-1	0.978	-1
0.90	7.200	-1	8.400	-1	1.012	-1	1.016	-1	1.020	-1	1.024	-1	1.028	-1
0.95	7.600	-1	8.800	-1	1.062	-1	1.066	-1	1.070	-1	1.074	-1	1.078	-1
0.98	8.000	-1	9.200	-1	1.112	-1	1.116	-1	1.120	-1	1.124	-1	1.128	-1
0.99	8.400	-1	9.600	-1	1.162	-1	1.166	-1	1.170	-1	1.174	-1	1.178	-1

Table 1-(b) Continued, for  $\rho = 0.1$ .

Table with columns labeled with values from 3.5 to 18.0 and rows labeled with values from 0.01 to 0.99. The table contains numerical data points for each combination of row and column values.







Table 3-(b) Continued, for  $\rho=0.3$ .

$F(x)/\bar{F}(x)$	3.5	4.0	4.5	5.0	6.0	7.0	8.0	9.0	10.0	12.0	14.0	16.0	18.0
0.01	0.3134	0.3879	0.4803	0.4938	0.4907	0.1370	0.5283	0.3114	0.1457	0.9313	0.1600	0.3741	0.6584
0.02	0.6380	0.7743	0.9771	0.1182	0.1776	0.2708	0.4034	0.3509	0.1860	0.2130	0.2665	0.4033	0.5654
0.03	0.9380	0.1139	0.1431	0.2468	0.3393	0.4325	0.5876	0.8464	0.1187	0.1494	0.3407	0.4974	0.6785
0.04	0.1249	0.1393	0.1525	0.2182	0.3152	0.4325	0.7825	1.0835	0.1894	0.2590	0.4021	0.5735	0.7887
0.05	0.1870	0.2325	0.2817	0.3443	0.4187	0.5042	0.7294	1.0305	0.2077	0.2856	0.4252	0.6085	0.8440
0.07	0.2179	0.2865	0.3700	0.4646	0.5612	0.6718	0.9123	1.2711	0.2312	0.3186	0.4645	0.6623	0.9144
0.08	0.2488	0.3362	0.4360	0.5464	0.6613	0.7973	1.0539	1.3900	0.2582	0.3564	0.4650	0.6802	0.9326
0.09	0.2809	0.3829	0.4943	0.6137	0.7408	0.8859	1.0355	1.2881	0.2731	0.3827	0.4878	0.7176	0.9784
0.10	0.3154	0.4349	0.5659	0.7073	0.8579	1.0265	1.2384	1.3714	0.2861	0.4050	0.5226	0.7588	1.0175
0.12	0.3546	0.4940	0.6407	0.7970	0.9577	1.1353	1.3992	1.5854	0.2979	0.4262	0.5492	0.7972	1.0684
0.14	0.3936	0.5546	0.7142	0.8809	0.2831	0.3735	0.4767	0.5955	0.7126	0.8432	1.0118	1.2141	1.4722
0.15	0.4281	0.6198	0.7927	0.9598	0.4419	0.5561	0.6800	0.8182	0.9600	1.1051	1.2641	1.4846	1.7671
0.16	0.4598	0.6815	0.8658	0.9572	0.5049	0.6361	0.7816	0.8960	1.0312	1.1812	1.3412	1.5184	1.8284
0.17	0.4798	0.7258	0.8294	0.9372	0.5612	0.6561	0.7656	0.8409	0.9917	1.1512	1.3112	1.4812	1.6512
0.18	0.4966	0.7549	0.8359	0.9259	0.6125	0.6745	0.7454	0.8134	1.0512	1.2112	1.3712	1.5312	1.7112
0.19	0.5113	0.7782	0.8438	0.9180	0.6582	0.6927	0.7624	0.8299	1.1012	1.2612	1.4212	1.5812	1.7712
0.20	0.5240	0.7960	0.8639	0.9372	0.7000	0.7100	0.7700	0.8300	1.1512	1.3112	1.4712	1.6312	1.8312
0.25	0.5600	0.8489	0.9279	0.9872	0.8004	0.8773	0.9338	0.9803	1.2512	1.4112	1.5712	1.7312	1.9312
0.30	0.6298	0.9358	1.0495	1.1356	1.1885	1.2185	1.2338	1.2411	1.3246	1.4846	1.6446	1.8046	1.9646
0.35	0.6868	1.0061	1.1205	1.1724	1.1772	1.1824	1.1874	1.1924	1.2781	1.4381	1.5981	1.7581	1.9181
0.40	0.7346	1.0649	1.1805	1.2261	1.2261	1.2311	1.2361	1.2411	1.3268	1.4868	1.6468	1.8068	1.9668
0.45	0.7761	1.1140	1.2318	1.2728	1.2728	1.2778	1.2828	1.2878	1.3735	1.5335	1.6935	1.8535	2.0135
0.50	0.8121	1.1568	1.2761	1.3164	1.3164	1.3214	1.3264	1.3314	1.4171	1.5771	1.7371	1.8971	2.0571
0.55	0.8430	1.1940	1.3147	1.3544	1.3544	1.3594	1.3644	1.3694	1.4548	1.6148	1.7748	1.9348	2.0948
0.60	0.8700	1.2271	1.3494	1.3884	1.3884	1.3934	1.3984	1.4034	1.4891	1.6491	1.8091	1.9691	2.1291
0.65	0.8940	1.2571	1.3715	1.4104	1.4104	1.4154	1.4204	1.4254	1.5108	1.6708	1.8308	1.9908	2.1508
0.70	0.9157	1.2846	1.3915	1.4294	1.4294	1.4344	1.4394	1.4444	1.5298	1.6898	1.8498	2.0098	2.1698
0.75	0.9345	1.3094	1.4085	1.4464	1.4464	1.4514	1.4564	1.4614	1.5468	1.7068	1.8668	2.0268	2.1868
0.80	0.9500	1.3318	1.4235	1.4614	1.4614	1.4664	1.4714	1.4764	1.5618	1.7218	1.8818	2.0418	2.2018
0.85	0.9635	1.3515	1.4365	1.4744	1.4744	1.4794	1.4844	1.4894	1.5748	1.7348	1.8948	2.0548	2.2148
0.90	0.9750	1.3684	1.4471	1.4864	1.4864	1.4914	1.4964	1.5014	1.5868	1.7468	1.9068	2.0668	2.2268
0.95	0.9840	1.3821	1.4558	1.4964	1.4964	1.5014	1.5064	1.5114	1.5968	1.7568	1.9168	2.0768	2.2368
0.99	0.9930	1.3946	1.4621	1.5044	1.5044	1.5094	1.5144	1.5194	1.6048	1.7648	1.9248	2.0848	2.2448
1.00	1.0000	1.4054	1.4671	1.5114	1.5114	1.5164	1.5214	1.5264	1.6118	1.7718	1.9318	2.0918	2.2518







Table 5-(a) Values of  $\eta$  for  $F(\eta|\xi)$  and  $\xi$ , for  $\rho=0.5$ .

$F(\eta \xi), \xi$	0.00	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	
0.001	0.509	-3	0.624	-3	0.709	-2	0.774	-2	0.818	-2	0.849	-2	0.869	-2
0.002	0.505	-2	0.620	-2	0.695	-2	0.760	-2	0.804	-2	0.835	-2	0.855	-2
0.003	0.502	-2	0.617	-2	0.692	-2	0.757	-2	0.801	-2	0.832	-2	0.852	-2
0.004	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.005	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.006	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.007	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.008	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.009	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.01	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.02	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.03	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.04	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.05	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.06	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.07	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.08	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.09	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.10	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.11	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.12	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.13	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.14	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.15	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.16	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.17	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.18	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.19	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.20	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.25	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.30	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.35	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.40	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.45	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.50	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.55	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.60	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.65	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.70	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.75	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.80	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.85	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.90	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
0.95	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2
1.00	0.500	-2	0.615	-2	0.690	-2	0.755	-2	0.799	-2	0.830	-2	0.850	-2





Table 6-(b) Continued, for  $\rho = 0.6$ .

$F(\eta/\xi)$	3.50	4.00	4.50	5.00	6.00	7.00	8.00	9.00	10.00	12.00	14.00	16.00	18.00
0.00	0.5769 +	0.9687 +	0.1483 -	0.2316 -	0.3682 -	0.5778 -	0.7742 -	0.1033 +	0.1670 +	0.1831 +	0.2443 +	0.3093 +	0.3778 +
0.02	0.5771 -	0.1547 -	0.2159 -	0.2987 -	0.4847 -	0.7018 -	0.9440 -	0.1207 +	0.1849 +	0.2077 +	0.2714 +	0.3468 +	0.4152 +
0.04	0.1298 -	0.1947 -	0.2722 -	0.3606 -	0.5649 -	0.7990 -	1.0571 -	0.1434 +	0.2160 +	0.2391 +	0.3084 +	0.3815 +	0.4571 +
0.06	0.1972 -	0.2856 -	0.3816 -	0.4852 -	0.7066 -	0.9375 -	1.1857 -	0.1615 +	0.2419 +	0.2646 +	0.3300 +	0.4049 +	0.4816 +
0.08	0.2633 -	0.3672 -	0.4830 -	0.6090 -	0.8480 -	0.9914 -	1.2179 +	0.1835 +	0.2709 +	0.2924 +	0.3546 +	0.4291 +	0.5084 +
0.10	0.2233 -	0.3117 -	0.4119 -	0.5220 -	0.7672 -	0.1039 -	0.1333 +	0.1569 +	0.1972 +	0.2273 +	0.2874 +	0.3574 +	0.4301 +
0.12	0.2819 -	0.3552 -	0.4382 -	0.5352 -	0.7396 -	0.1122 +	0.1427 +	0.1750 +	0.2087 +	0.2381 +	0.2984 +	0.3684 +	0.4419 +
0.14	0.2756 -	0.3746 -	0.4653 -	0.5653 -	0.6650 -	0.1158 +	0.1468 +	0.1801 +	0.2137 +	0.2431 +	0.3034 +	0.3734 +	0.4469 +
0.16	0.4031 -	0.5272 -	0.6593 -	0.8000 -	0.1428 +	0.1770 +	0.2131 +	0.2502 +	0.2802 +	0.3096 +	0.3699 +	0.4399 +	0.5100 +
0.18	0.5019 -	0.6380 -	0.7866 -	0.9385 -	0.1186 +	0.1614 +	0.1980 +	0.2358 +	0.2641 +	0.2934 +	0.3537 +	0.4237 +	0.4942 +
0.20	0.5823 -	0.7300 -	0.8885 -	0.1050 -	0.1396 +	0.1782 +	0.2162 +	0.2538 +	0.2913 +	0.3288 +	0.3891 +	0.4591 +	0.5292 +
0.22	0.6524 -	0.8092 -	0.9782 -	0.1116 +	0.1564 +	0.1957 +	0.2332 +	0.2708 +	0.3083 +	0.3458 +	0.4061 +	0.4761 +	0.5462 +
0.24	0.7125 -	0.8894 -	0.1124 +	0.1309 +	0.1694 +	0.2086 +	0.2462 +	0.2838 +	0.3213 +	0.3588 +	0.4191 +	0.4891 +	0.5592 +
0.26	0.7726 -	0.1005 -	0.1189 +	0.1380 +	0.1775 +	0.2167 +	0.2541 +	0.2916 +	0.3291 +	0.3666 +	0.4269 +	0.4969 +	0.5670 +
0.28	0.8327 -	0.1101 +	0.1251 +	0.1446 +	0.1841 +	0.2234 +	0.2608 +	0.2983 +	0.3358 +	0.3733 +	0.4336 +	0.5036 +	0.5737 +
0.30	0.8928 -	0.1116 +	0.1264 +	0.1464 +	0.1858 +	0.2245 +	0.2620 +	0.2995 +	0.3370 +	0.3745 +	0.4348 +	0.5048 +	0.5749 +
0.32	0.9529 -	0.1125 +	0.1273 +	0.1477 +	0.1874 +	0.2254 +	0.2630 +	0.3005 +	0.3380 +	0.3755 +	0.4358 +	0.5058 +	0.5759 +
0.34	0.1016 +	0.1213 +	0.1417 +	0.1625 +	0.2054 +	0.2483 +	0.2912 +	0.3287 +	0.3662 +	0.4037 +	0.4640 +	0.5340 +	0.6041 +
0.36	0.1059 +	0.1260 +	0.1465 +	0.1674 +	0.2103 +	0.2532 +	0.2961 +	0.3336 +	0.3711 +	0.4086 +	0.4689 +	0.5389 +	0.6090 +
0.38	0.1100 +	0.1305 +	0.1510 +	0.1719 +	0.2148 +	0.2577 +	0.3006 +	0.3381 +	0.3756 +	0.4131 +	0.4734 +	0.5434 +	0.6135 +
0.40	0.1140 +	0.1352 +	0.1557 +	0.1766 +	0.2195 +	0.2624 +	0.3049 +	0.3424 +	0.3799 +	0.4174 +	0.4777 +	0.5477 +	0.6178 +
0.42	0.1180 +	0.1404 +	0.1609 +	0.1818 +	0.2244 +	0.2673 +	0.3098 +	0.3473 +	0.3848 +	0.4223 +	0.4826 +	0.5526 +	0.6227 +
0.44	0.1220 +	0.1456 +	0.1661 +	0.1870 +	0.2283 +	0.2712 +	0.3137 +	0.3512 +	0.3887 +	0.4262 +	0.4865 +	0.5565 +	0.6266 +
0.46	0.1260 +	0.1508 +	0.1713 +	0.1927 +	0.2322 +	0.2751 +	0.3176 +	0.3551 +	0.3926 +	0.4301 +	0.4904 +	0.5604 +	0.6305 +
0.48	0.1300 +	0.1560 +	0.1765 +	0.1979 +	0.2361 +	0.2790 +	0.3215 +	0.3590 +	0.3965 +	0.4340 +	0.4943 +	0.5643 +	0.6345 +
0.50	0.1340 +	0.1612 +	0.1817 +	0.2031 +	0.2400 +	0.2824 +	0.3249 +	0.3624 +	0.3999 +	0.4374 +	0.4977 +	0.5677 +	0.6378 +
0.52	0.1380 +	0.1664 +	0.1871 +	0.2085 +	0.2439 +	0.2863 +	0.3288 +	0.3663 +	0.4038 +	0.4413 +	0.5016 +	0.5716 +	0.6419 +
0.54	0.1420 +	0.1716 +	0.1923 +	0.2130 +	0.2478 +	0.2897 +	0.3327 +	0.3702 +	0.4077 +	0.4452 +	0.5055 +	0.5755 +	0.6460 +
0.56	0.1460 +	0.1768 +	0.1975 +	0.2174 +	0.2517 +	0.2926 +	0.3366 +	0.3741 +	0.4116 +	0.4491 +	0.5094 +	0.5794 +	0.6501 +
0.58	0.1500 +	0.1820 +	0.2027 +	0.2218 +	0.2556 +	0.2965 +	0.3405 +	0.3780 +	0.4155 +	0.4530 +	0.5133 +	0.5833 +	0.6542 +
0.60	0.1540 +	0.1872 +	0.2079 +	0.2262 +	0.2595 +	0.2994 +	0.3444 +	0.3819 +	0.4189 +	0.4564 +	0.5167 +	0.5867 +	0.6583 +
0.62	0.1580 +	0.1924 +	0.2121 +	0.2306 +	0.2634 +	0.3033 +	0.3483 +	0.3858 +	0.4228 +	0.4603 +	0.5206 +	0.5906 +	0.6624 +
0.64	0.1620 +	0.1976 +	0.2163 +	0.2350 +	0.2673 +	0.3072 +	0.3522 +	0.3897 +	0.4267 +	0.4642 +	0.5250 +	0.5950 +	0.6665 +
0.66	0.1660 +	0.2028 +	0.2205 +	0.2395 +	0.2712 +	0.3111 +	0.3561 +	0.3936 +	0.4306 +	0.4681 +	0.5279 +	0.5979 +	0.6706 +
0.68	0.1700 +	0.2080 +	0.2247 +	0.2439 +	0.2751 +	0.3150 +	0.3595 +	0.3970 +	0.4345 +	0.4720 +	0.5313 +	0.6013 +	0.6747 +
0.70	0.1740 +	0.2132 +	0.2299 +	0.2483 +	0.2790 +	0.3189 +	0.3634 +	0.4009 +	0.4384 +	0.4759 +	0.5352 +	0.6052 +	0.6788 +
0.72	0.1780 +	0.2184 +	0.2341 +	0.2527 +	0.2829 +	0.3228 +	0.3673 +	0.4048 +	0.4423 +	0.4798 +	0.5391 +	0.6091 +	0.6829 +
0.74	0.1820 +	0.2236 +	0.2393 +	0.2571 +	0.2868 +	0.3267 +	0.3712 +	0.4087 +	0.4462 +	0.4837 +	0.5430 +	0.6130 +	0.6870 +
0.76	0.1860 +	0.2288 +	0.2441 +	0.2615 +	0.2907 +	0.3306 +	0.3751 +	0.4126 +	0.4501 +	0.4876 +	0.5469 +	0.6169 +	0.6911 +
0.78	0.1900 +	0.2340 +	0.2493 +	0.2653 +	0.2946 +	0.3345 +	0.3790 +	0.4165 +	0.4540 +	0.4915 +	0.5508 +	0.6208 +	0.6952 +
0.80	0.1940 +	0.2392 +	0.2541 +	0.2691 +	0.2985 +	0.3384 +	0.3829 +	0.4204 +	0.4579 +	0.4954 +	0.5557 +	0.6247 +	0.7003 +
0.82	0.1980 +	0.2444 +	0.2589 +	0.2729 +	0.3024 +	0.3423 +	0.3868 +	0.4243 +	0.4618 +	0.4993 +	0.5596 +	0.6286 +	0.7044 +
0.84	0.2020 +	0.2496 +	0.2637 +	0.2767 +	0.3063 +	0.3462 +	0.3907 +	0.4282 +	0.4657 +	0.5032 +	0.5630 +	0.6325 +	0.7085 +
0.86	0.2060 +	0.2548 +	0.2685 +	0.2805 +	0.3102 +	0.3501 +	0.3946 +	0.4321 +	0.4706 +	0.5081 +	0.5679 +	0.6364 +	0.7126 +
0.88	0.2100 +	0.2600 +	0.2733 +	0.2843 +	0.3141 +	0.3540 +	0.3985 +	0.4360 +	0.4755 +	0.5130 +	0.5728 +	0.6403 +	0.7167 +
0.90	0.2140 +	0.2652 +	0.2781 +	0.2881 +	0.3180 +	0.3579 +	0.4024 +	0.4399 +	0.4804 +	0.5179 +	0.5777 +	0.6442 +	0.7208 +
0.92	0.2180 +	0.2704 +	0.2829 +	0.2929 +	0.3219 +	0.3618 +	0.4063 +	0.4438 +	0.4853 +	0.5228 +	0.5826 +	0.6481 +	0.7249 +
0.94	0.2220 +	0.2756 +	0.2877 +	0.2977 +	0.3258 +	0.3657 +	0.4102 +	0.4477 +	0.4897 +	0.5267 +	0.5865 +	0.6520 +	0.7290 +
0.96	0.2260 +	0.2808 +	0.2927 +	0.3027 +	0.3297 +	0.3696 +	0.4141 +	0.4511 +	0.4940 +	0.5310 +	0.5908 +	0.6559 +	0.7331 +
0.98	0.2300 +	0.2860 +	0.2979 +	0.3079 +	0.3336 +	0.3735 +	0.4180 +	0.4530 +	0.4969 +	0.5339 +	0.5937 +	0.6598 +	0.7372 +
1.00	0.2340 +	0.2912 +	0.3031 +	0.3131 +	0.3375 +	0.3774 +	0.4219 +	0.4549 +	0.4988 +	0.5368 +	0.5966 +	0.6637 +	0.7413 +





Table 8-(a) Values of  $\gamma$  for  $F(\gamma|\xi)$  and  $\xi$ , for  $\rho=0.8$ .

$F(\gamma \xi)/\xi$	0.00	0.25	0.50	0.75	1.00	1.25	1.50	2.00	2.25	2.50	2.75	3.00
0.001	0.3003	0.5437	0.7145	0.8345	0.9164	0.9732	1.0138	1.0434	1.0651	1.0807	1.0927	1.1016
0.002	0.4004	0.6187	0.7914	0.8912	0.9585	1.0052	1.0364	1.0568	1.0707	1.0807	1.0886	1.0950
0.003	0.6009	0.8131	0.9386	0.9982	1.0411	1.0714	1.0921	1.1061	1.1151	1.1210	1.1253	1.1291
0.004	0.8016	0.9215	0.9827	1.0256	1.0561	1.0774	1.0921	1.1011	1.1061	1.1094	1.1121	1.1144
0.005	1.0022	0.7718	0.7289	0.6841	0.6384	0.5926	0.5467	0.5007	0.4547	0.4087	0.3627	0.3167
0.007	0.1405	0.2806	0.4207	0.5608	0.7009	0.8410	0.9811	1.1212	1.2613	1.4014	1.5415	1.6816
0.008	0.1606	0.4349	0.7092	1.0835	1.5578	2.1321	2.8064	3.5807	4.4550	5.4293	6.5036	7.6779
0.009	0.1808	0.4893	0.8289	1.3032	2.0275	3.0018	4.3261	6.0004	8.0247	10.4090	13.1533	16.2576
0.01	0.2010	0.5437	0.9327	1.4070	2.1213	3.1456	4.5700	6.4043	8.6486	11.3029	14.3672	17.8415
0.02	0.3003	0.6932	1.1822	1.8065	2.6208	3.7451	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.03	0.4004	0.8164	1.2177	1.7275	2.5722	3.7465	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.04	0.5005	0.9165	1.2532	1.7630	2.6077	3.7820	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.05	0.6006	1.0166	1.2887	1.7985	2.6432	3.8175	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.06	0.7007	1.1167	1.3242	1.8340	2.6787	3.8530	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.07	0.8008	1.2168	1.3597	1.8695	2.7142	3.8885	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.08	0.9009	1.3169	1.3952	1.9050	2.7497	3.9240	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.09	1.0010	1.4170	1.4307	1.9405	2.7852	3.9595	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.10	1.1011	1.5171	1.4662	1.9760	2.8207	3.9950	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.11	1.2012	1.6172	1.5017	2.0115	2.8562	4.0305	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.12	1.3013	1.7173	1.5372	2.0470	2.8917	4.0660	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.13	1.4014	1.8174	1.5727	2.0825	2.9272	4.1015	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.14	1.5015	1.9175	1.6082	2.1180	2.9627	4.1370	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.15	1.6016	2.0176	1.6437	2.1535	2.9982	4.1725	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.16	1.7017	2.1177	1.6792	2.1890	3.0337	4.2080	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.17	1.8018	2.2178	1.7147	2.2245	3.0692	4.2435	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.18	1.9019	2.3179	1.7502	2.2600	3.1047	4.2790	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.19	2.0020	2.4180	1.7857	2.2955	3.1402	4.3145	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.20	2.1021	2.5181	1.8212	2.3310	3.1757	4.3499	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.25	2.5025	2.9185	1.9116	2.4214	3.2661	4.4403	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.30	2.9029	3.3189	1.9920	2.5118	3.3565	4.5307	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.35	3.3033	3.7193	2.0724	2.6022	3.4469	4.6211	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.40	3.7037	4.1197	2.1528	2.6926	3.5373	4.7115	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.45	4.1041	4.5201	2.2332	2.7830	3.6277	4.8019	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.50	4.5045	4.9205	2.3136	2.8734	3.7181	4.8923	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.55	4.9049	5.3209	2.3940	2.9638	3.8085	4.9827	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.60	5.3053	5.7213	2.4744	3.0542	3.8989	5.0731	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.65	5.7057	6.1217	2.5548	3.1446	3.9893	5.1635	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.70	6.1061	6.5221	2.6352	3.2350	4.0797	5.2539	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.75	6.5065	6.9225	2.7156	3.3254	4.1701	5.3443	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.80	6.9069	7.3229	2.7960	3.4158	4.2605	5.4347	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.85	7.3073	7.7233	2.8764	3.5062	4.3509	5.5251	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.90	7.7077	8.1237	2.9568	3.5966	4.4413	5.6155	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
0.95	8.1081	8.5241	3.0372	3.6870	4.5317	5.7059	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115
1.00	8.5085	8.9245	3.1176	3.7774	4.6221	5.7963	5.2700	7.3043	9.8486	12.9029	16.4572	20.5115





Table 9-(a) Values of  $\gamma$  for  $F(\eta|\xi)$  and  $\xi$ , for  $\rho=0.9$ .

$F(\eta \xi)$	0.00	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
0.001	0.151	0.152	0.153	0.154	0.155	0.156	0.157	0.158	0.159	0.160	0.161	0.162	0.163
0.002	0.162	0.163	0.164	0.165	0.166	0.167	0.168	0.169	0.170	0.171	0.172	0.173	0.174
0.003	0.173	0.174	0.175	0.176	0.177	0.178	0.179	0.180	0.181	0.182	0.183	0.184	0.185
0.004	0.184	0.185	0.186	0.187	0.188	0.189	0.190	0.191	0.192	0.193	0.194	0.195	0.196
0.005	0.196	0.197	0.198	0.199	0.200	0.201	0.202	0.203	0.204	0.205	0.206	0.207	0.208
0.006	0.208	0.209	0.210	0.211	0.212	0.213	0.214	0.215	0.216	0.217	0.218	0.219	0.220
0.007	0.220	0.221	0.222	0.223	0.224	0.225	0.226	0.227	0.228	0.229	0.230	0.231	0.232
0.008	0.232	0.233	0.234	0.235	0.236	0.237	0.238	0.239	0.240	0.241	0.242	0.243	0.244
0.009	0.244	0.245	0.246	0.247	0.248	0.249	0.250	0.251	0.252	0.253	0.254	0.255	0.256
0.01	0.257	0.258	0.259	0.260	0.261	0.262	0.263	0.264	0.265	0.266	0.267	0.268	0.269
0.011	0.270	0.271	0.272	0.273	0.274	0.275	0.276	0.277	0.278	0.279	0.280	0.281	0.282
0.012	0.282	0.283	0.284	0.285	0.286	0.287	0.288	0.289	0.290	0.291	0.292	0.293	0.294
0.013	0.295	0.296	0.297	0.298	0.299	0.300	0.301	0.302	0.303	0.304	0.305	0.306	0.307
0.014	0.309	0.310	0.311	0.312	0.313	0.314	0.315	0.316	0.317	0.318	0.319	0.320	0.321
0.015	0.323	0.324	0.325	0.326	0.327	0.328	0.329	0.330	0.331	0.332	0.333	0.334	0.335
0.016	0.337	0.338	0.339	0.340	0.341	0.342	0.343	0.344	0.345	0.346	0.347	0.348	0.349
0.017	0.351	0.352	0.353	0.354	0.355	0.356	0.357	0.358	0.359	0.360	0.361	0.362	0.363
0.018	0.365	0.366	0.367	0.368	0.369	0.370	0.371	0.372	0.373	0.374	0.375	0.376	0.377
0.019	0.380	0.381	0.382	0.383	0.384	0.385	0.386	0.387	0.388	0.389	0.390	0.391	0.392
0.02	0.394	0.395	0.396	0.397	0.398	0.399	0.400	0.401	0.402	0.403	0.404	0.405	0.406
0.021	0.410	0.411	0.412	0.413	0.414	0.415	0.416	0.417	0.418	0.419	0.420	0.421	0.422
0.022	0.425	0.426	0.427	0.428	0.429	0.430	0.431	0.432	0.433	0.434	0.435	0.436	0.437
0.023	0.440	0.441	0.442	0.443	0.444	0.445	0.446	0.447	0.448	0.449	0.450	0.451	0.452
0.024	0.455	0.456	0.457	0.458	0.459	0.460	0.461	0.462	0.463	0.464	0.465	0.466	0.467
0.025	0.470	0.471	0.472	0.473	0.474	0.475	0.476	0.477	0.478	0.479	0.480	0.481	0.482
0.026	0.485	0.486	0.487	0.488	0.489	0.490	0.491	0.492	0.493	0.494	0.495	0.496	0.497
0.027	0.510	0.511	0.512	0.513	0.514	0.515	0.516	0.517	0.518	0.519	0.520	0.521	0.522
0.028	0.525	0.526	0.527	0.528	0.529	0.530	0.531	0.532	0.533	0.534	0.535	0.536	0.537
0.029	0.550	0.551	0.552	0.553	0.554	0.555	0.556	0.557	0.558	0.559	0.560	0.561	0.562
0.03	0.565	0.566	0.567	0.568	0.569	0.570	0.571	0.572	0.573	0.574	0.575	0.576	0.577
0.031	0.590	0.591	0.592	0.593	0.594	0.595	0.596	0.597	0.598	0.599	0.600	0.601	0.602
0.032	0.605	0.606	0.607	0.608	0.609	0.610	0.611	0.612	0.613	0.614	0.615	0.616	0.617
0.033	0.630	0.631	0.632	0.633	0.634	0.635	0.636	0.637	0.638	0.639	0.640	0.641	0.642
0.034	0.645	0.646	0.647	0.648	0.649	0.650	0.651	0.652	0.653	0.654	0.655	0.656	0.657
0.035	0.670	0.671	0.672	0.673	0.674	0.675	0.676	0.677	0.678	0.679	0.680	0.681	0.682
0.036	0.685	0.686	0.687	0.688	0.689	0.690	0.691	0.692	0.693	0.694	0.695	0.696	0.697
0.037	0.710	0.711	0.712	0.713	0.714	0.715	0.716	0.717	0.718	0.719	0.720	0.721	0.722
0.038	0.725	0.726	0.727	0.728	0.729	0.730	0.731	0.732	0.733	0.734	0.735	0.736	0.737
0.039	0.750	0.751	0.752	0.753	0.754	0.755	0.756	0.757	0.758	0.759	0.760	0.761	0.762
0.04	0.765	0.766	0.767	0.768	0.769	0.770	0.771	0.772	0.773	0.774	0.775	0.776	0.777
0.041	0.790	0.791	0.792	0.793	0.794	0.795	0.796	0.797	0.798	0.799	0.800	0.801	0.802
0.042	0.805	0.806	0.807	0.808	0.809	0.810	0.811	0.812	0.813	0.814	0.815	0.816	0.817
0.043	0.830	0.831	0.832	0.833	0.834	0.835	0.836	0.837	0.838	0.839	0.840	0.841	0.842
0.044	0.845	0.846	0.847	0.848	0.849	0.850	0.851	0.852	0.853	0.854	0.855	0.856	0.857
0.045	0.870	0.871	0.872	0.873	0.874	0.875	0.876	0.877	0.878	0.879	0.880	0.881	0.882
0.046	0.885	0.886	0.887	0.888	0.889	0.890	0.891	0.892	0.893	0.894	0.895	0.896	0.897
0.047	0.910	0.911	0.912	0.913	0.914	0.915	0.916	0.917	0.918	0.919	0.920	0.921	0.922
0.048	0.925	0.926	0.927	0.928	0.929	0.930	0.931	0.932	0.933	0.934	0.935	0.936	0.937
0.049	0.950	0.951	0.952	0.953	0.954	0.955	0.956	0.957	0.958	0.959	0.960	0.961	0.962
0.05	0.965	0.966	0.967	0.968	0.969	0.970	0.971	0.972	0.973	0.974	0.975	0.976	0.977
0.051	0.990	0.991	0.992	0.993	0.994	0.995	0.996	0.997	0.998	0.999	1.000	1.001	1.002

