UNIVERSIDAD TECNOLOGICA NACIONAL
Facultad Regional Buenos Aires
Departamento UDB Matemática

Probabilidad y Estadística

Guía de Tablas y Fórmulas

Buenos Aires, Argentina, 2019

II

Índice general

Tablas

1.1. Distribución Binomial

$$X \sim Bi(n,p) \ \ 0 \le p \le 1 \ \Rightarrow P(X \le k) = \sum_{i=0}^{k} P(X = i) = \sum_{i=0}^{k} \binom{n}{i} p^i (1-p)^{n-i} \ \ \text{para} \ \ 0 \le k \le n.$$

$$E(X) = np,$$

$$V(X) = np(1-p)$$

		p										
n	**k**	**0.05**	**0.1**	**0.2**	**0.25**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
2	**0**	0.9025	0.8100	0.6400	0.5625	0.4900	0.3600	0.2500	0.1600	0.0900	0.0400	0.0100
	1	0.9975	0.9900	0.9600	0.9375	0.9100	0.8400	0.7500	0.6400	0.5100	0.3600	0.1900
3	**0**	0.8574	0.7290	0.5120	0.4219	0.3430	0.2160	0.1250	0.0640	0.0270	0.0080	0.0010
	1	0.9928	0.9720	0.8960	0.8438	0.7840	0.6480	0.5000	0.3520	0.2160	0.1040	0.0280
	2	0.9999	0.9990	0.9920	0.9844	0.9730	0.9360	0.8750	0.7840	0.6570	0.4880	0.2710
4	**0**	0.8145	0.6561	0.4096	0.3164	0.2401	0.1296	0.0625	0.0256	0.0081	0.0016	0.0001
	1	0.9860	0.9477	0.8192	0.7383	0.6517	0.4752	0.3125	0.1792	0.0837	0.0272	0.0037
	2	0.9995	0.9963	0.9728	0.9492	0.9163	0.8208	0.6875	0.5248	0.3483	0.1808	0.0523
	3	1.0000	0.9999	0.9984	0.9961	0.9919	0.9744	0.9375	0.8704	0.7599	0.5904	0.3439
5	**0**	0.7738	0.5905	0.3277	0.2373	0.1681	0.0778	0.0313	0.0102	0.0024	0.0003	0.0000
	1	0.9774	0.9185	0.7373	0.6328	0.5282	0.3370	0.1875	0.0870	0.0308	0.0067	0.0005
	2	0.9988	0.9914	0.9421	0.8965	0.8369	0.6826	0.5000	0.3174	0.1631	0.0579	0.0086
	3	1.0000	0.9995	0.9933	0.9844	0.9692	0.9130	0.8125	0.6630	0.4718	0.2627	0.0815
	4	1.0000	1.0000	0.9997	0.9990	0.9976	0.9898	0.9688	0.9222	0.8319	0.6723	0.4095

		p										
n	k	0.05	0.1	0.2	0.25	0.3	0.4	0.5	0.6	0.7	0.8	0.9
6	0	0.7351	0.5314	0.2621	0.1780	0.1176	0.0467	0.0156	0.0041	0.0007	0.0001	0.0000
	1	0.9672	0.8857	0.6554	0.5339	0.4202	0.2333	0.1094	0.0410	0.0109	0.0016	0.0001
	2	0.9978	0.9842	0.9011	0.8306	0.7443	0.5443	0.3438	0.1792	0.0705	0.0170	0.0013
	3	0.9999	0.9987	0.9830	0.9624	0.9295	0.8208	0.6563	0.4557	0.2557	0.0989	0.0159
	4	1.0000	0.9999	0.9984	0.9954	0.9891	0.9590	0.8906	0.7667	0.5798	0.3446	0.1143
	5	1.0000	1.0000	0.9999	0.9998	0.9993	0.9959	0.9844	0.9533	0.8824	0.7379	0.4686
7	0	0.6983	0.4783	0.2097	0.1335	0.0824	0.0280	0.0078	0.0016	0.0002	0.0000	0.0000
	1	0.9556	0.8503	0.5767	0.4449	0.3294	0.1586	0.0625	0.0188	0.0038	0.0004	0.0000
	2	0.9962	0.9743	0.8520	0.7564	0.6471	0.4199	0.2266	0.0963	0.0288	0.0047	0.0002
	3	0.9998	0.9973	0.9667	0.9294	0.8740	0.7102	0.5000	0.2898	0.1260	0.0333	0.0027
	4	1.0000	0.9998	0.9953	0.9871	0.9712	0.9037	0.7734	0.5801	0.3529	0.1480	0.0257
	5	1.0000	1.0000	0.9996	0.9987	0.9962	0.9812	0.9375	0.8414	0.6706	0.4233	0.1497
	6	1.0000	1.0000	1.0000	0.9999	0.9998	0.9984	0.9922	0.9720	0.9176	0.7903	0.5217
8	0	0.6634	0.4305	0.1678	0.1001	0.0576	0.0168	0.0039	0.0007	0.0001	0.0000	0.0000
	1	0.9428	0.8131	0.5033	0.3671	0.2553	0.1064	0.0352	0.0085	0.0013	0.0001	0.0000
	2	0.9942	0.9619	0.7969	0.6785	0.5518	0.3154	0.1445	0.0498	0.0113	0.0012	0.0000
	3	0.9996	0.9950	0.9437	0.8862	0.8059	0.5941	0.3633	0.1737	0.0580	0.0104	0.0004
	4	1.0000	0.9996	0.9896	0.9727	0.9420	0.8263	0.6367	0.4059	0.1941	0.0563	0.0050
	5	1.0000	1.0000	0.9988	0.9958	0.9887	0.9502	0.8555	0.6846	0.4482	0.2031	0.0381
	6	1.0000	1.0000	0.9999	0.9996	0.9987	0.9915	0.9648	0.8936	0.7447	0.4967	0.1869
	7	1.0000	1.0000	1.0000	1.0000	0.9999	0.9993	0.9961	0.9832	0.9424	0.8322	0.5695
9	0	0.6302	0.3874	0.1342	0.0751	0.0404	0.0101	0.0020	0.0003	0.0000	0.0000	0.0000
	1	0.9288	0.7748	0.4362	0.3003	0.1960	0.0705	0.0195	0.0038	0.0004	0.0000	0.0000
	2	0.9916	0.9470	0.7382	0.6007	0.4628	0.2318	0.0898	0.0250	0.0043	0.0003	0.0000
	3	0.9994	0.9917	0.9144	0.8343	0.7297	0.4826	0.2539	0.0994	0.0253	0.0031	0.0001
	4	1.0000	0.9991	0.9804	0.9511	0.9012	0.7334	0.5000	0.2666	0.0988	0.0196	0.0009
	5	1.0000	0.9999	0.9969	0.9900	0.9747	0.9006	0.7461	0.5174	0.2703	0.0856	0.0083
	6	1.0000	1.0000	0.9997	0.9987	0.9957	0.9750	0.9102	0.7682	0.5372	0.2618	0.0530
	7	1.0000	1.0000	1.0000	0.9999	0.9996	0.9962	0.9805	0.9295	0.8040	0.5638	0.2252
	8	1.0000	1.0000	1.0000	1.0000	1.0000	0.9997	0.9980	0.9899	0.9596	0.8658	0.6126

							p					
n	k	0.05	0.1	0.2	0.25	0.3	0.4	0.5	0.6	0.7	0.8	0.9
10	0	0.3774	0.1351	0.0144	0.0042	0.0011	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.9139	0.7361	0.3758	0.2440	0.1493	0.0464	0.0107	0.0017	0.0001	0.0000	0.0000
	2	0.9885	0.9298	0.6778	0.5256	0.3828	0.1673	0.0547	0.0123	0.0016	0.0001	0.0000
	3	0.9990	0.9872	0.8791	0.7759	0.6496	0.3823	0.1719	0.0548	0.0106	0.0009	0.0000
	4	0.9999	0.9984	0.9672	0.9219	0.8497	0.6331	0.3770	0.1662	0.0473	0.0064	0.0001
	5	1.0000	0.9999	0.9936	0.9803	0.9527	0.8338	0.6230	0.3669	0.1503	0.0328	0.0016
	6	1.0000	1.0000	0.9991	0.9965	0.9894	0.9452	0.8281	0.6177	0.3504	0.1209	0.0128
	7	1.0000	1.0000	0.9999	0.9996	0.9984	0.9877	0.9453	0.8327	0.6172	0.3222	0.0702
	8	1.0000	1.0000	1.0000	1.0000	0.9999	0.9983	0.9893	0.9536	0.8507	0.6242	0.2639
	9	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9990	0.9940	0.9718	0.8926	0.6513
11	0	0.5688	0.3138	0.0859	0.0422	0.0198	0.0036	0.0005	0.0000	0.0000	0.0000	0.0000
	1	0.8981	0.6974	0.3221	0.1971	0.1130	0.0302	0.0059	0.0007	0.0000	0.0000	0.0000
	2	0.9848	0.9104	0.6174	0.4552	0.3127	0.1189	0.0327	0.0059	0.0006	0.0000	0.0000
	3	0.9984	0.9815	0.8389	0.7133	0.5696	0.2963	0.1133	0.0293	0.0043	0.0002	0.0000
	4	0.9999	0.9972	0.9496	0.8854	0.7897	0.5328	0.2744	0.0994	0.0216	0.0020	0.0000
	5	1.0000	0.9997	0.9883	0.9657	0.9218	0.7535	0.5000	0.2465	0.0782	0.0117	0.0003
	6	1.0000	1.0000	0.9980	0.9924	0.9784	0.9006	0.7256	0.4672	0.2103	0.0504	0.0028
	7	1.0000	1.0000	0.9998	0.9988	0.9957	0.9707	0.8867	0.7037	0.4304	0.1611	0.0185
	8	1.0000	1.0000	1.0000	0.9999	0.9994	0.9941	0.9673	0.8811	0.6873	0.3826	0.0896
	9	1.0000	1.0000	1.0000	1.0000	1.0000	0.9993	0.9941	0.9698	0.8870	0.6779	0.3026
	10	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9995	0.9964	0.9802	0.9141	0.6862
12	0	0.5404	0.2824	0.0687	0.0317	0.0138	0.0022	0.0002	0.0000	0.0000	0.0000	0.0000
	1	0.8816	0.6590	0.2749	0.1584	0.0850	0.0196	0.0032	0.0003	0.0000	0.0000	0.0000
	2	0.9804	0.8891	0.5583	0.3907	0.2528	0.0834	0.0193	0.0028	0.0002	0.0000	0.0000
	3	0.9978	0.9744	0.7946	0.6488	0.4925	0.2253	0.0730	0.0153	0.0017	0.0001	0.0000
	4	0.9998	0.9957	0.9274	0.8424	0.7237	0.4382	0.1938	0.0573	0.0095	0.0006	0.0000
	5	1.0000	0.9995	0.9806	0.9456	0.8822	0.6652	0.3872	0.1582	0.0386	0.0039	0.0001
	6	1.0000	0.9999	0.9961	0.9857	0.9614	0.8418	0.6128	0.3348	0.1178	0.0194	0.0005
	7	1.0000	1.0000	0.9994	0.9972	0.9905	0.9427	0.8062	0.5618	0.2763	0.0726	0.0043
	8	1.0000	1.0000	0.9999	0.9996	0.9983	0.9847	0.9270	0.7747	0.5075	0.2054	0.0256
	9	1.0000	1.0000	1.0000	1.0000	0.9998	0.9972	0.9807	0.9166	0.7472	0.4417	0.1109
	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.9997	0.9968	0.9804	0.9150	0.7251	0.3410
	11	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9998	0.9978	0.9862	0.9313	0.7176

		p										
n	k	0.05	0.1	0.2	0.25	0.3	0.4	0.5	0.6	0.7	0.8	0.9
13	0	0.5133	0.2542	0.0550	0.0238	0.0097	0.0013	0.0001	0.0000	0.0000	0.0000	0.0000
	1	0.8646	0.6213	0.2336	0.1267	0.0637	0.0126	0.0017	0.0001	0.0000	0.0000	0.0000
	2	0.9755	0.8661	0.5017	0.3326	0.2025	0.0579	0.0112	0.0013	0.0001	0.0000	0.0000
	3	0.9969	0.9658	0.7473	0.5843	0.4206	0.1686	0.0461	0.0078	0.0007	0.0000	0.0000
	4	0.9997	0.9935	0.9009	0.7940	0.6543	0.3530	0.1334	0.0321	0.0040	0.0002	0.0000
	5	1.0000	0.9991	0.9700	0.9198	0.8346	0.5744	0.2905	0.0977	0.0182	0.0012	0.0000
	6	1.0000	0.9999	0.9930	0.9757	0.9376	0.7712	0.5000	0.2288	0.0624	0.0070	0.0001
	7	1.0000	1.0000	0.9988	0.9944	0.9818	0.9023	0.7095	0.4256	0.1654	0.0300	0.0009
	8	1.0000	1.0000	0.9998	0.9990	0.9960	0.9679	0.8666	0.6470	0.3457	0.0991	0.0065
	9	1.0000	1.0000	1.0000	0.9999	0.9993	0.9922	0.9539	0.8314	0.5794	0.2527	0.0342
	10	1.0000	1.0000	1.0000	1.0000	0.9999	0.9987	0.9888	0.9421	0.7975	0.4983	0.1339
	11	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9983	0.9874	0.9363	0.7664	0.3787
	12	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9987	0.9903	0.9450	0.7458
14	0	0.4877	0.2288	0.0440	0.0178	0.0068	0.0008	0.0001	0.0000	0.0000	0.0000	0.0000
	1	0.8470	0.5846	0.1979	0.1010	0.0475	0.0081	0.0009	0.0001	0.0000	0.0000	0.0000
	2	0.9699	0.8416	0.4481	0.2811	0.1608	0.0398	0.0065	0.0006	0.0000	0.0000	0.0000
	3	0.9958	0.9559	0.6982	0.5213	0.3552	0.1243	0.0287	0.0039	0.0002	0.0000	0.0000
	4	0.9996	0.9908	0.8702	0.7415	0.5842	0.2793	0.0898	0.0175	0.0017	0.0000	0.0000
	5	1.0000	0.9985	0.9561	0.8883	0.7805	0.4859	0.2120	0.0583	0.0083	0.0004	0.0000
	6	1.0000	0.9998	0.9884	0.9617	0.9067	0.6925	0.3953	0.1501	0.0315	0.0024	0.0000
	7	1.0000	1.0000	0.9976	0.9897	0.9685	0.8499	0.6047	0.3075	0.0933	0.0116	0.0002
	8	1.0000	1.0000	0.9996	0.9978	0.9917	0.9417	0.7880	0.5141	0.2195	0.0439	0.0015
	9	1.0000	1.0000	1.0000	0.9997	0.9983	0.9825	0.9102	0.7207	0.4158	0.1298	0.0092
	10	1.0000	1.0000	1.0000	1.0000	0.9998	0.9961	0.9713	0.8757	0.6448	0.3018	0.0441
	11	1.0000	1.0000	1.0000	1.0000	1.0000	0.9994	0.9935	0.9602	0.8392	0.5519	0.1584
	12	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9991	0.9919	0.9525	0.8021	0.4154
	13	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9992	0.9932	0.9560	0.7712

		p										
n	k	0.05	0.1	0.2	0.25	0.3	0.4	0.5	0.6	0.7	0.8	0.9
15	0	0.4633	0.2059	0.0352	0.0134	0.0047	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.8290	0.5490	0.1671	0.0802	0.0353	0.0052	0.0005	0.0000	0.0000	0.0000	0.0000
	2	0.9638	0.8159	0.3980	0.2361	0.1268	0.0271	0.0037	0.0003	0.0000	0.0000	0.0000
	3	0.9945	0.9444	0.6482	0.4613	0.2969	0.0905	0.0176	0.0019	0.0001	0.0000	0.0000
	4	0.9994	0.9873	0.8358	0.6865	0.5155	0.2173	0.0592	0.0093	0.0007	0.0000	0.0000
	5	0.9999	0.9978	0.9389	0.8516	0.7216	0.4032	0.1509	0.0338	0.0037	0.0001	0.0000
	6	1.0000	0.9997	0.9819	0.9434	0.8689	0.6098	0.3036	0.0950	0.0152	0.0008	0.0000
	7	1.0000	1.0000	0.9958	0.9827	0.9500	0.7869	0.5000	0.2131	0.0500	0.0042	0.0000
	8	1.0000	1.0000	0.9992	0.9958	0.9848	0.9050	0.6964	0.3902	0.1311	0.0181	0.0003
	9	1.0000	1.0000	0.9999	0.9992	0.9963	0.9662	0.8491	0.5968	0.2784	0.0611	0.0022
	10	1.0000	1.0000	1.0000	0.9999	0.9993	0.9907	0.9408	0.7827	0.4845	0.1642	0.0127
	11	1.0000	1.0000	1.0000	1.0000	0.9999	0.9981	0.9824	0.9095	0.7031	0.3518	0.0556
	12	1.0000	1.0000	1.0000	1.0000	1.0000	0.9997	0.9963	0.9729	0.8732	0.6020	0.1841
	13	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9995	0.9948	0.9647	0.8329	0.4510
	14	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9995	0.9953	0.9648	0.7941
16	0	0.4401	0.1853	0.0281	0.0100	0.0033	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.8108	0.5147	0.1407	0.0635	0.0261	0.0033	0.0003	0.0000	0.0000	0.0000	0.0000
	2	0.9571	0.7892	0.3518	0.1971	0.0994	0.0183	0.0021	0.0001	0.0000	0.0000	0.0000
	3	0.9930	0.9316	0.5981	0.4050	0.2459	0.0651	0.0106	0.0009	0.0000	0.0000	0.0000
	4	0.9991	0.9830	0.7982	0.6302	0.4499	0.1666	0.0384	0.0049	0.0003	0.0000	0.0000
	5	0.9999	0.9967	0.9183	0.8103	0.6598	0.3288	0.1051	0.0191	0.0016	0.0000	0.0000
	6	1.0000	0.9995	0.9733	0.9204	0.8247	0.5272	0.2272	0.0583	0.0071	0.0002	0.0000
	7	1.0000	0.9999	0.9930	0.9729	0.9256	0.7161	0.4018	0.1423	0.0257	0.0015	0.0000
	8	1.0000	1.0000	0.9985	0.9925	0.9743	0.8577	0.5982	0.2839	0.0744	0.0070	0.0001
	9	1.0000	1.0000	0.9998	0.9984	0.9929	0.9417	0.7728	0.4728	0.1753	0.0267	0.0005
	10	1.0000	1.0000	1.0000	0.9997	0.9984	0.9809	0.8949	0.6712	0.3402	0.0817	0.0033
	11	1.0000	1.0000	1.0000	1.0000	0.9997	0.9951	0.9616	0.8334	0.5501	0.2018	0.0170
	12	1.0000	1.0000	1.0000	1.0000	1.0000	0.9991	0.9894	0.9349	0.7541	0.4019	0.0684
	13	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9979	0.9817	0.9006	0.6482	0.2108
	14	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9997	0.9967	0.9739	0.8593	0.4853
	15	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9997	0.9967	0.9719	0.8147

							p					
n	k	0.05	0.1	0.2	0.25	0.3	0.4	0.5	0.6	0.7	0.8	0.9
17	0	0.4181	0.1668	0.0225	0.0075	0.0023	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.7922	0.4818	0.1182	0.0501	0.0193	0.0021	0.0001	0.0000	0.0000	0.0000	0.0000
	2	0.9497	0.7618	0.3096	0.1637	0.0774	0.0123	0.0012	0.0001	0.0000	0.0000	0.0000
	3	0.9912	0.9174	0.5489	0.3530	0.2019	0.0464	0.0064	0.0005	0.0000	0.0000	0.0000
	4	0.9988	0.9779	0.7582	0.5739	0.3887	0.1260	0.0245	0.0025	0.0001	0.0000	0.0000
	5	0.9999	0.9953	0.8943	0.7653	0.5968	0.2639	0.0717	0.0106	0.0007	0.0000	0.0000
	6	1.0000	0.9992	0.9623	0.8929	0.7752	0.4478	0.1662	0.0348	0.0032	0.0001	0.0000
	7	1.0000	0.9999	0.9891	0.9598	0.8954	0.6405	0.3145	0.0919	0.0127	0.0005	0.0000
	8	1.0000	1.0000	0.9974	0.9876	0.9597	0.8011	0.5000	0.1989	0.0403	0.0026	0.0000
	9	1.0000	1.0000	0.9995	0.9969	0.9873	0.9081	0.6855	0.3595	0.1046	0.0109	0.0001
	10	1.0000	1.0000	0.9999	0.9994	0.9968	0.9652	0.8338	0.5522	0.2248	0.0377	0.0008
	11	1.0000	1.0000	1.0000	0.9999	0.9993	0.9894	0.9283	0.7361	0.4032	0.1057	0.0047
	12	1.0000	1.0000	1.0000	1.0000	0.9999	0.9975	0.9755	0.8740	0.6113	0.2418	0.0221
	13	1.0000	1.0000	1.0000	1.0000	1.0000	0.9995	0.9936	0.9536	0.7981	0.4511	0.0826
	14	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9988	0.9877	0.9226	0.6904	0.2382
	15	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9979	0.9807	0.8818	0.5182
	16	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9998	0.9977	0.9775	0.8332
18	0	0.3972	0.1501	0.0180	0.0056	0.0016	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.7735	0.4503	0.0991	0.0395	0.0142	0.0013	0.0001	0.0000	0.0000	0.0000	0.0000
	2	0.9419	0.7338	0.2713	0.1353	0.0600	0.0082	0.0007	0.0000	0.0000	0.0000	0.0000
	3	0.9891	0.9018	0.5010	0.3057	0.1646	0.0328	0.0038	0.0002	0.0000	0.0000	0.0000
	4	0.9985	0.9718	0.7164	0.5187	0.3327	0.0942	0.0154	0.0013	0.0000	0.0000	0.0000
	5	0.9998	0.9936	0.8671	0.7175	0.5344	0.2088	0.0481	0.0058	0.0003	0.0000	0.0000
	6	1.0000	0.9988	0.9487	0.8610	0.7217	0.3743	0.1189	0.0203	0.0014	0.0000	0.0000
	7	1.0000	0.9998	0.9837	0.9431	0.8593	0.5634	0.2403	0.0576	0.0061	0.0002	0.0000
	8	1.0000	1.0000	0.9957	0.9807	0.9404	0.7368	0.4073	0.1347	0.0210	0.0009	0.0000
	9	1.0000	1.0000	0.9991	0.9946	0.9790	0.8653	0.5927	0.2632	0.0596	0.0043	0.0000
	10	1.0000	1.0000	0.9998	0.9988	0.9939	0.9424	0.7597	0.4366	0.1407	0.0163	0.0002
	11	1.0000	1.0000	1.0000	0.9998	0.9986	0.9797	0.8811	0.6257	0.2783	0.0513	0.0012
	12	1.0000	1.0000	1.0000	1.0000	0.9997	0.9942	0.9519	0.7912	0.4656	0.1329	0.0064
	13	1.0000	1.0000	1.0000	1.0000	1.0000	0.9987	0.9846	0.9058	0.6673	0.2836	0.0282
	14	1.0000	1.0000	1.0000	1.0000	1.0000	0.9998	0.9962	0.9672	0.8354	0.4990	0.0982
	15	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9993	0.9918	0.9400	0.7287	0.2662
	16	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9987	0.9858	0.9009	0.5497
	17	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9984	0.9820	0.8499

							p					
n	k	0.05	0.1	0.2	0.25	0.3	0.4	0.5	0.6	0.7	0.8	0.9
19	0	0.3774	0.1351	0.0144	0.0042	0.0011	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.7547	0.4203	0.0829	0.0310	0.0104	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000
	2	0.9335	0.7054	0.2369	0.1113	0.0462	0.0055	0.0004	0.0000	0.0000	0.0000	0.0000
	3	0.9868	0.8850	0.4551	0.2631	0.1332	0.0230	0.0022	0.0001	0.0000	0.0000	0.0000
	4	0.9980	0.9648	0.6733	0.4654	0.2822	0.0696	0.0096	0.0006	0.0000	0.0000	0.0000
	5	0.9998	0.9914	0.8369	0.6678	0.4739	0.1629	0.0318	0.0031	0.0001	0.0000	0.0000
	6	1.0000	0.9983	0.9324	0.8251	0.6655	0.3081	0.0835	0.0116	0.0006	0.0000	0.0000
	7	1.0000	0.9997	0.9767	0.9225	0.8180	0.4878	0.1796	0.0352	0.0028	0.0000	0.0000
	8	1.0000	1.0000	0.9933	0.9713	0.9161	0.6675	0.3238	0.0885	0.0105	0.0003	0.0000
	9	1.0000	1.0000	0.9984	0.9911	0.9674	0.8139	0.5000	0.1861	0.0326	0.0016	0.0000
	10	1.0000	1.0000	0.9997	0.9977	0.9895	0.9115	0.6762	0.3325	0.0839	0.0067	0.0000
	11	1.0000	1.0000	1.0000	0.9995	0.9972	0.9648	0.8204	0.5122	0.1820	0.0233	0.0003
	12	1.0000	1.0000	1.0000	0.9999	0.9994	0.9884	0.9165	0.6919	0.3345	0.0676	0.0017
	13	1.0000	1.0000	1.0000	1.0000	0.9999	0.9969	0.9682	0.8371	0.5261	0.1631	0.0086
	14	1.0000	1.0000	1.0000	1.0000	1.0000	0.9994	0.9904	0.9304	0.7178	0.3267	0.0352
	15	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9978	0.9770	0.8668	0.5449	0.1150
	16	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9996	0.9945	0.9538	0.7631	0.2946
	17	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9992	0.9896	0.9171	0.5797
	18	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9989	0.9856	0.8649
20	0	0.3585	0.1216	0.0115	0.0032	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.7358	0.3917	0.0692	0.0243	0.0076	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000
	2	0.9245	0.6769	0.2061	0.0913	0.0355	0.0036	0.0002	0.0000	0.0000	0.0000	0.0000
	3	0.9841	0.8670	0.4114	0.2252	0.1071	0.0160	0.0013	0.0000	0.0000	0.0000	0.0000
	4	0.9974	0.9568	0.6296	0.4148	0.2375	0.0510	0.0059	0.0003	0.0000	0.0000	0.0000
	5	0.9997	0.9887	0.8042	0.6172	0.4164	0.1256	0.0207	0.0016	0.0000	0.0000	0.0000
	6	1.0000	0.9976	0.9133	0.7858	0.6080	0.2500	0.0577	0.0065	0.0003	0.0000	0.0000
	7	1.0000	0.9996	0.9679	0.8982	0.7723	0.4159	0.1316	0.0210	0.0013	0.0000	0.0000
	8	1.0000	0.9999	0.9900	0.9591	0.8867	0.5956	0.2517	0.0565	0.0051	0.0001	0.0000
	9	1.0000	1.0000	0.9974	0.9861	0.9520	0.7553	0.4119	0.1275	0.0171	0.0006	0.0000
	10	1.0000	1.0000	0.9994	0.9961	0.9829	0.8725	0.5881	0.2447	0.0480	0.0026	0.0000
	11	1.0000	1.0000	0.9999	0.9991	0.9949	0.9435	0.7483	0.4044	0.1133	0.0100	0.0001
	12	1.0000	1.0000	1.0000	0.9998	0.9987	0.9790	0.8684	0.5841	0.2277	0.0321	0.0004
	13	1.0000	1.0000	1.0000	1.0000	0.9997	0.9935	0.9423	0.7500	0.3920	0.0867	0.0024
	14	1.0000	1.0000	1.0000	1.0000	1.0000	0.9984	0.9793	0.8744	0.5836	0.1958	0.0113
	15	1.0000	1.0000	1.0000	1.0000	1.0000	0.9997	0.9941	0.9490	0.7625	0.3704	0.0432
	16	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9987	0.9840	0.8929	0.5886	0.1330
	17	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9998	0.9964	0.9645	0.7939	0.3231
	18	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9995	0.9924	0.9308	0.6083
	19	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9992	0.9885	0.8784

1.2. Distribución Poisson

$$X \sim Po(\lambda) \ \text{con} \ \lambda > 0 \Rightarrow Po(X \leq r) = \sum_{i=0}^{r} P(X = i) = \sum_{i=0}^{r} \frac{e^{-\lambda}\lambda^i}{i!} \ \ \text{con} \ r \in \{0, 1, 2, \cdots\}$$

$$E(X) = \lambda, \quad V(X) = \lambda$$

						λ					
r	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	1.5
0	0.9048	0.8187	0.7408	0.6703	0.6065	0.5488	0.4966	0.4493	0.4066	0.3679	0.2231
1	0.9953	0.9825	0.9631	0.9384	0.9098	0.8781	0.8442	0.8088	0.7725	0.7358	0.5578
2	0.9998	0.9989	0.9964	0.9921	0.9856	0.9769	0.9659	0.9526	0.9371	0.9197	0.8088
3	1.0000	0.9999	0.9997	0.9992	0.9982	0.9966	0.9942	0.9909	0.9865	0.9810	0.9344
4		1.0000	1.0000	0.9999	0.9998	0.9996	0.9992	0.9986	0.9977	0.9963	0.9814
5				1.0000	1.0000	1.0000	0.9999	0.9998	0.9997	0.9994	0.9955
6							1.0000	1.0000	1.0000	0.9999	0.9991
7										1.0000	0.9998
8											1.0000

						λ					
r	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0
0	0.1353	0.0821	0.0498	0.0302	0.0183	0.0111	0.0067	0.0041	0.0025	0.0015	0.0009
1	0.4060	0.2873	0.1991	0.1359	0.0916	0.0611	0.0404	0.0266	0.0174	0.0113	0.0073
2	0.6767	0.5438	0.4232	0.3208	0.2381	0.1736	0.1247	0.0884	0.0620	0.0430	0.0296
3	0.8571	0.7576	0.6472	0.5366	0.4335	0.3423	0.2650	0.2017	0.1512	0.1118	0.0818
4	0.9473	0.8912	0.8153	0.7254	0.6288	0.5321	0.4405	0.3575	0.2851	0.2237	0.1730
5	0.9834	0.9580	0.9161	0.8576	0.7851	0.7029	0.6160	0.5289	0.4457	0.3690	0.3007
6	0.9955	0.9858	0.9665	0.9347	0.8893	0.8311	0.7622	0.6860	0.6063	0.5265	0.4497
7	0.9989	0.9958	0.9881	0.9733	0.9489	0.9134	0.8666	0.8095	0.7440	0.6728	0.5987
8	0.9998	0.9989	0.9962	0.9901	0.9786	0.9597	0.9319	0.8944	0.8472	0.7916	0.7291
9	1.0000	0.9997	0.9989	0.9967	0.9919	0.9829	0.9682	0.9462	0.9161	0.8774	0.8305
10		0.9999	0.9997	0.9990	0.9972	0.9933	0.9863	0.9747	0.9574	0.9332	0.9015
11		1.0000	0.9999	0.9997	0.9991	0.9976	0.9945	0.9890	0.9799	0.9661	0.9467
12			1.0000	0.9999	0.9997	0.9992	0.9980	0.9955	0.9912	0.9840	0.9730
13				1.0000	0.9999	0.9997	0.9993	0.9983	0.9964	0.9929	0.9872
14					1.0000	0.9999	0.9998	0.9994	0.9986	0.9970	0.9943
15						1.0000	0.9999	0.9998	0.9995	0.9988	0.9976
16							1.0000	0.9999	0.9998	0.9996	0.9990
17								1.0000	0.9999	0.9998	0.9996
18									1.0000	0.9999	0.9999
19										1.0000	1.0000

|	λ												
r	8.0	8.5	9.0	9.5	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0
0	0.0003	0.0002	0.0001	0.0001	0.0000	0.0000	0.0000						
1	0.0030	0.0019	0.0012	0.0008	0.0005	0.0002	0.0001	0.0000	0.0000				
2	0.0138	0.0093	0.0062	0.0042	0.0028	0.0012	0.0005	0.0002	0.0001	0.0000	0.0000		
3	0.0424	0.0301	0.0212	0.0149	0.0103	0.0049	0.0023	0.0011	0.0005	0.0002	0.0001	0.0000	0.0000
4	0.0996	0.0744	0.0550	0.0403	0.0293	0.0151	0.0076	0.0037	0.0018	0.0009	0.0004	0.0002	0.0001
5	0.1912	0.1496	0.1157	0.0885	0.0671	0.0375	0.0203	0.0107	0.0055	0.0028	0.0014	0.0007	0.0003
6	0.3134	0.2562	0.2068	0.1649	0.1301	0.0786	0.0458	0.0259	0.0142	0.0076	0.0040	0.0021	0.0010
7	0.4530	0.3856	0.3239	0.2687	0.2202	0.1432	0.0895	0.0540	0.0316	0.0180	0.0100	0.0054	0.0029
8	0.5925	0.5231	0.4557	0.3918	0.3328	0.2320	0.1550	0.0998	0.0621	0.0374	0.0220	0.0126	0.0071
9	0.7166	0.6530	0.5874	0.5218	0.4579	0.3405	0.2424	0.1658	0.1094	0.0699	0.0433	0.0261	0.0154
10	0.8159	0.7634	0.7060	0.6453	0.5830	0.4599	0.3472	0.2517	0.1757	0.1185	0.0774	0.0491	0.0304
11	0.8881	0.8487	0.8030	0.7520	0.6968	0.5793	0.4616	0.3532	0.2600	0.1848	0.1270	0.0847	0.0549
12	0.9362	0.9091	0.8758	0.8364	0.7916	0.6887	0.5760	0.4631	0.3585	0.2676	0.1931	0.1350	0.0917
13	0.9658	0.9486	0.9261	0.8981	0.8645	0.7813	0.6815	0.5730	0.4644	0.3632	0.2745	0.2009	0.1426
14	0.9827	0.9726	0.9585	0.9400	0.9165	0.8540	0.7720	0.6751	0.5704	0.4657	0.3675	0.2808	0.2081
15	0.9918	0.9862	0.9780	0.9665	0.9513	0.9074	0.8444	0.7636	0.6694	0.5681	0.4667	0.3715	0.2867
16	0.9963	0.9934	0.9889	0.9823	0.9730	0.9441	0.8987	0.8355	0.7559	0.6641	0.5660	0.4677	0.3751
17	0.9984	0.9970	0.9947	0.9911	0.9857	0.9678	0.9370	0.8905	0.8272	0.7489	0.6593	0.5640	0.4686
18	0.9993	0.9987	0.9976	0.9957	0.9928	0.9823	0.9626	0.9302	0.8826	0.8195	0.7423	0.6550	0.5622
19	0.9997	0.9995	0.9989	0.9980	0.9965	0.9907	0.9787	0.9573	0.9235	0.8752	0.8122	0.7363	0.6509
20	0.9999	0.9998	0.9996	0.9991	0.9984	0.9953	0.9884	0.9750	0.9521	0.9170	0.8682	0.8055	0.7307
21	1.0000	0.9999	0.9998	0.9996	0.9993	0.9977	0.9939	0.9859	0.9712	0.9469	0.9108	0.8615	0.7991
22		1.0000	0.9999	0.9999	0.9997	0.9990	0.9970	0.9924	0.9833	0.9673	0.9418	0.9047	0.8551
23			1.0000	0.9999	0.9999	0.9995	0.9985	0.9960	0.9907	0.9805	0.9633	0.9367	0.8989
24				1.0000	1.0000	0.9998	0.9993	0.9980	0.9950	0.9888	0.9777	0.9594	0.9317
25						0.9999	0.9997	0.9990	0.9974	0.9938	0.9869	0.9748	0.9554
26						1.0000	0.9999	0.9995	0.9987	0.9967	0.9925	0.9848	0.9718
27							0.9999	0.9998	0.9994	0.9983	0.9959	0.9912	0.9827
28							1.0000	0.9999	0.9997	0.9991	0.9978	0.9950	0.9897
29								1.0000	0.9999	0.9996	0.9989	0.9973	0.9941
30									0.9999	0.9998	0.9994	0.9986	0.9967
31									1.0000	0.9999	0.9997	0.9993	0.9982
32										1.0000	0.9999	0.9996	0.9990
33											0.9999	0.9998	0.9995
34											1.0000	0.9999	0.9998
35												1.0000	0.9999
36													0.9999
37													1.0000

1.3. Distribución Normal

$$X \sim N(\mu, \sigma^2) \text{ con } \mu \in \mathbb{R} \text{ y } \sigma \in \mathbb{R}_{\geq 0} \Rightarrow f_X(x) = \frac{1}{\sqrt{2\pi}\sigma} e^{-(x-\mu)^2/2\sigma^2} \text{ con } x \in \mathbb{R}$$

$$E(X) = \mu, \quad V(X) = \sigma^2$$

$$X \sim N(\mu, \sigma^2) \Rightarrow Z = \frac{X - \mu}{\sigma} \sim N(0, 1)$$

$$Z \sim N(0,1) \Rightarrow \Phi(z) = P(Z \leq z) = \int_{-\infty}^{z} \phi(z)dz = \int_{-\infty}^{z} \frac{1}{\sqrt{2\pi}} e^{-z^2/2} dz$$

$$E(Z) = 0, \quad V(Z) = 1$$
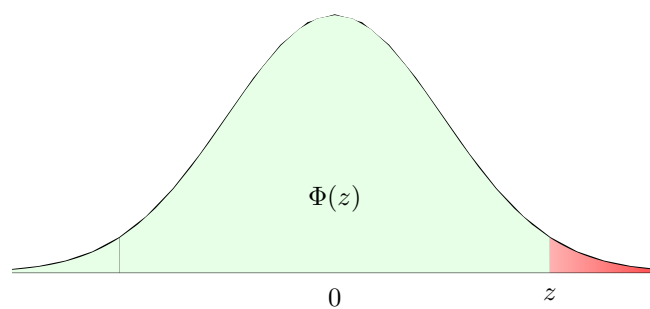
Z	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0	0.5	0.49601	0.49202	0.48803	0.48405	0.48006	0.47608	0.4721	0.46812	0.46414
-0.1	0.46017	0.4562	0.45224	0.44828	0.44433	0.44038	0.43644	0.43251	0.42858	0.42465
-0.2	0.42074	0.41683	0.41294	0.40905	0.40517	0.40129	0.39743	0.39358	0.38974	0.38591
-0.3	0.38209	0.37828	0.37448	0.3707	0.36693	0.36317	0.35942	0.35569	0.35197	0.34827
-0.4	0.34458	0.3409	0.33724	0.3336	0.32997	0.32636	0.32276	0.31918	0.31561	0.31207
-0.5	0.30854	0.30503	0.30153	0.29806	0.2946	0.29116	0.28774	0.28434	0.28096	0.2776
-0.6	0.27425	0.27093	0.26763	0.26435	0.26109	0.25785	0.25463	0.25143	0.24825	0.2451
-0.7	0.24196	0.23885	0.23576	0.2327	0.22965	0.22663	0.22363	0.22065	0.2177	0.21476
-0.8	0.21186	0.20897	0.20611	0.20327	0.20045	0.19766	0.19489	0.19215	0.18943	0.18673
-0.9	0.18406	0.18141	0.17879	0.17619	0.17361	0.17106	0.16853	0.16602	0.16354	0.16109
-1	0.15866	0.15625	0.15386	0.15151	0.14917	0.14686	0.14457	0.14231	0.14007	0.13786
-1.1	0.13567	0.1335	0.13136	0.12924	0.12714	0.12507	0.12302	0.121	0.119	0.11702
-1.2	0.11507	0.11314	0.11123	0.10935	0.10749	0.10565	0.10383	0.10204	0.10027	0.09853
-1.3	0.0968	0.0951	0.09342	0.09176	0.09012	0.08851	0.08692	0.08534	0.08379	0.08226
-1.4	0.08076	0.07927	0.0778	0.07636	0.07493	0.07353	0.07215	0.07078	0.06944	0.06811
-1.5	0.06681	0.06552	0.06426	0.06301	0.06178	0.06057	0.05938	0.05821	0.05705	0.05592
-1.6	0.0548	0.0537	0.05262	0.05155	0.0505	0.04947	0.04846	0.04746	0.04648	0.04551
-1.7	0.04457	0.04363	0.04272	0.04182	0.04093	0.04006	0.0392	0.03836	0.03754	0.03673
-1.8	0.03593	0.03515	0.03438	0.03362	0.03288	0.03216	0.03144	0.03074	0.03005	0.02938
-1.9	0.02872	0.02807	0.02743	0.0268	0.02619	0.02559	0.025	0.02442	0.02385	0.0233
-2	0.02275	0.02222	0.02169	0.02118	0.02068	0.02018	0.0197	0.01923	0.01876	0.01831
-2.1	0.01786	0.01743	0.017	0.01659	0.01618	0.01578	0.01539	0.015	0.01463	0.01426
-2.2	0.0139	0.01355	0.01321	0.01287	0.01255	0.01222	0.01191	0.0116	0.0113	0.01101
-2.3	0.01072	0.01044	0.01017	0.0099	0.00964	0.00939	0.00914	0.00889	0.00866	0.00842
-2.4	0.0082	0.00798	0.00776	0.00755	0.00734	0.00714	0.00695	0.00676	0.00657	0.00639
-2.5	0.00621	0.00604	0.00587	0.0057	0.00554	0.00539	0.00523	0.00508	0.00494	0.0048
-2.6	0.00466	0.00453	0.0044	0.00427	0.00415	0.00402	0.00391	0.00379	0.00368	0.00357
-2.7	0.00347	0.00336	0.00326	0.00317	0.00307	0.00298	0.00289	0.0028	0.00272	0.00264
-2.8	0.00256	0.00248	0.0024	0.00233	0.00226	0.00219	0.00212	0.00205	0.00199	0.00193
-2.9	0.00187	0.00181	0.00175	0.00169	0.00164	0.00159	0.00154	0.00149	0.00144	0.00139
-3	0.00135	0.00131	0.00126	0.00122	0.00118	0.00114	0.00111	0.00107	0.00104	0.001

z	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0	0.5	0.50399	0.50798	0.51197	0.51595	0.51994	0.52392	0.5279	0.53188	0.53586
0.1	0.53983	0.5438	0.54776	0.55172	0.55567	0.55962	0.56356	0.56749	0.57142	0.57535
0.2	0.57926	0.58317	0.58706	0.59095	0.59483	0.59871	0.60257	0.60642	0.61026	0.61409
0.3	0.61791	0.62172	0.62552	0.6293	0.63307	0.63683	0.64058	0.64431	0.64803	0.65173
0.4	0.65542	0.6591	0.66276	0.6664	0.67003	0.67364	0.67724	0.68082	0.68439	0.68793
0.5	0.69146	0.69497	0.69847	0.70194	0.7054	0.70884	0.71226	0.71566	0.71904	0.7224
0.6	0.72575	0.72907	0.73237	0.73565	0.73891	0.74215	0.74537	0.74857	0.75175	0.7549
0.7	0.75804	0.76115	0.76424	0.7673	0.77035	0.77337	0.77637	0.77935	0.7823	0.78524
0.8	0.78814	0.79103	0.79389	0.79673	0.79955	0.80234	0.80511	0.80785	0.81057	0.81327
0.9	0.81594	0.81859	0.82121	0.82381	0.82639	0.82894	0.83147	0.83398	0.83646	0.83891
1	0.84134	0.84375	0.84614	0.84849	0.85083	0.85314	0.85543	0.85769	0.85993	0.86214
1.1	0.86433	0.8665	0.86864	0.87076	0.87286	0.87493	0.87698	0.879	0.881	0.88298
1.2	0.88493	0.88686	0.88877	0.89065	0.89251	0.89435	0.89617	0.89796	0.89973	0.90147
1.3	0.9032	0.9049	0.90658	0.90824	0.90988	0.91149	0.91308	0.91466	0.91621	0.91774
1.4	0.91924	0.92073	0.9222	0.92364	0.92507	0.92647	0.92785	0.92922	0.93056	0.93189
1.5	0.93319	0.93448	0.93574	0.93699	0.93822	0.93943	0.94062	0.94179	0.94295	0.94408
1.6	0.9452	0.9463	0.94738	0.94845	0.9495	0.95053	0.95154	0.95254	0.95352	0.95449
1.7	0.95543	0.95637	0.95728	0.95818	0.95907	0.95994	0.9608	0.96164	0.96246	0.96327
1.8	0.96407	0.96485	0.96562	0.96638	0.96712	0.96784	0.96856	0.96926	0.96995	0.97062
1.9	0.97128	0.97193	0.97257	0.9732	0.97381	0.97441	0.975	0.97558	0.97615	0.9767
2	0.97725	0.97778	0.97831	0.97882	0.97932	0.97982	0.9803	0.98077	0.98124	0.98169
2.1	0.98214	0.98257	0.983	0.98341	0.98382	0.98422	0.98461	0.985	0.98537	0.98574
2.2	0.9861	0.98645	0.98679	0.98713	0.98745	0.98778	0.98809	0.9884	0.9887	0.98899
2.3	0.98928	0.98956	0.98983	0.9901	0.99036	0.99061	0.99086	0.99111	0.99134	0.99158
2.4	0.9918	0.99202	0.99224	0.99245	0.99266	0.99286	0.99305	0.99324	0.99343	0.99361
2.5	0.99379	0.99396	0.99413	0.9943	0.99446	0.99461	0.99477	0.99492	0.99506	0.9952
2.6	0.99534	0.99547	0.9956	0.99573	0.99585	0.99598	0.99609	0.99621	0.99632	0.99643
2.7	0.99653	0.99664	0.99674	0.99683	0.99693	0.99702	0.99711	0.9972	0.99728	0.99736
2.8	0.99744	0.99752	0.9976	0.99767	0.99774	0.99781	0.99788	0.99795	0.99801	0.99807
2.9	0.99813	0.99819	0.99825	0.99831	0.99836	0.99841	0.99846	0.99851	0.99856	0.99861
3	0.99865	0.99869	0.99874	0.99878	0.99882	0.99886	0.99889	0.99893	0.99896	0.999

1.4. Distribución Gamma

$$X \sim \Gamma(\alpha, \lambda) \Rightarrow f(x) = \lambda^\alpha \frac{e^{-\lambda x} x^{\alpha-1}}{\Gamma(\alpha)} \quad \text{con} \quad x \in \mathbb{R}^+$$

Algunos autores usan otra notación:

$$X \sim \Gamma(\alpha, \beta) \Rightarrow f(x) = \frac{e^{-x/\beta} x^{\alpha-1}}{\beta^\alpha \Gamma(\alpha)} \quad \text{con} \quad x \in \mathbb{R}^+$$
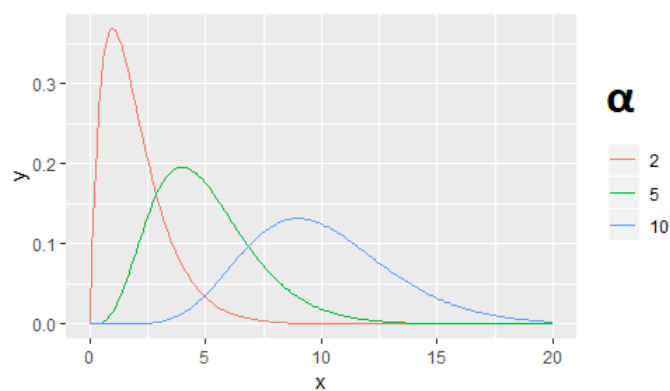
$$E(X) = \alpha/\lambda = \alpha\beta$$

$$V(X) = \alpha/\lambda^2 = \alpha\beta^2$$

La suma de k variables aleatorias independientes de distribución exponencial con parámetro λ es una variable aleatoria de distribución $\Gamma(k, \lambda)$.

Propiedad Importante

$$X \sim \Gamma(\alpha, \lambda) \Rightarrow \lambda X \sim \Gamma(\alpha, 1)$$

A la distribucion $\Gamma(\alpha, 1)$ se la conoce como distribución **gamma standard** y su forma varía según el parámetro α como muestra la siguiente figura.

La distribución de probabilidades acumulada de la distribución Gamma standard está tabulada a continuación.

x	1	2	3	4	5	6	7	8	9	10	15	20
						α						
0.1	0.09516	0.00468	0.00015	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
0.5	0.39347	0.09020	0.01439	0.00175	0.00017	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
1	0.63212	0.26424	0.08030	0.01899	0.00366	0.00059	0.00008	0.00001	0.00000	0.00000	0.00000	0.00000
2	0.86466	0.59399	0.32332	0.14288	0.05265	0.01656	0.00453	0.00110	0.00024	0.00005	0.00000	0.00000
3	0.95021	0.80085	0.57681	0.35277	0.18474	0.08392	0.03351	0.01190	0.00380	0.00110	0.00000	0.00000
4	0.98168	0.90842	0.76190	0.56653	0.37116	0.21487	0.11067	0.05113	0.02136	0.00813	0.00002	0.00000
5	0.99326	0.95957	0.87535	0.73497	0.55951	0.38404	0.23782	0.13337	0.06809	0.03183	0.00023	0.00000
6	0.99752	0.98265	0.93803	0.84880	0.71494	0.55432	0.39370	0.25602	0.15276	0.08392	0.00140	0.00001
7	0.99909	0.99270	0.97036	0.91823	0.82701	0.69929	0.55029	0.40129	0.27091	0.16950	0.00572	0.00004
8	0.99966	0.99698	0.98625	0.95762	0.90037	0.80876	0.68663	0.54704	0.40745	0.28338	0.01726	0.00025
9	0.99988	0.99877	0.99377	0.97877	0.94504	0.88431	0.79322	0.67610	0.54435	0.41259	0.04147	0.00106
10	0.99995	0.99950	0.99723	0.98966	0.97075	0.93291	0.86986	0.77978	0.66718	0.54207	0.08346	0.00345
11	0.99998	0.99980	0.99879	0.99508	0.98490	0.96248	0.92139	0.85681	0.76801	0.65949	0.14596	0.00929
12	0.99999	0.99992	0.99948	0.99771	0.99240	0.97966	0.95418	0.91050	0.84497	0.75761	0.22798	0.02128
13	1.00000	0.99997	0.99978	0.99895	0.99626	0.98927	0.97411	0.94597	0.90024	0.83419	0.32487	0.04267
14	1.00000	0.99999	0.99991	0.99953	0.99819	0.99447	0.98577	0.96838	0.93794	0.89060	0.42956	0.07650
15	1.00000	1.00000	0.99996	0.99979	0.99914	0.99721	0.99237	0.98200	0.96255	0.93015	0.53435	0.12478
16	1.00000	1.00000	0.99998	0.99991	0.99960	0.99862	0.99599	0.99000	0.97801	0.95670	0.63247	0.18775
17	1.00000	1.00000	0.99999	0.99996	0.99982	0.99933	0.99794	0.99457	0.98740	0.97388	0.71917	0.26368
18	1.00000	1.00000	1.00000	0.99998	0.99992	0.99968	0.99896	0.99711	0.99294	0.98462	0.79192	0.34908
19	1.00000	1.00000	1.00000	0.99999	0.99996	0.99985	0.99948	0.99849	0.99613	0.99114	0.85025	0.43939
20	1.00000	1.00000	1.00000	1.00000	0.99998	0.99993	0.99974	0.99922	0.99791	0.99500	0.89514	0.52974
21	1.00000	1.00000	1.00000	1.00000	0.99999	0.99997	0.99988	0.99961	0.99889	0.99723	0.92843	0.61574
22	1.00000	1.00000	1.00000	1.00000	1.00000	0.99998	0.99994	0.99980	0.99942	0.99850	0.95231	0.69397
23	1.00000	1.00000	1.00000	1.00000	1.00000	0.99999	0.99997	0.99990	0.99970	0.99919	0.96893	0.76229
24	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.99999	0.99995	0.99985	0.99957	0.98017	0.81974
25	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.99999	0.99998	0.99992	0.99978	0.98760	0.86643
26	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.99999	0.99996	0.99989	0.99238	0.90318
27	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.99999	0.99998	0.99994	0.99540	0.93128
28	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.99999	0.99997	0.99727	0.95219
29	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.99999	0.99840	0.96737
30	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	0.99999	0.99908	0.97813

1.5. Distribución Chi cuadrado

Siendo $Z_1, Z_2, ..., Z_k$ variables aleatoriasindependientes con distribución normal standard y la variable aleatoria X definida por $X = Z_1^2 + \cdots + Z_k^2$.
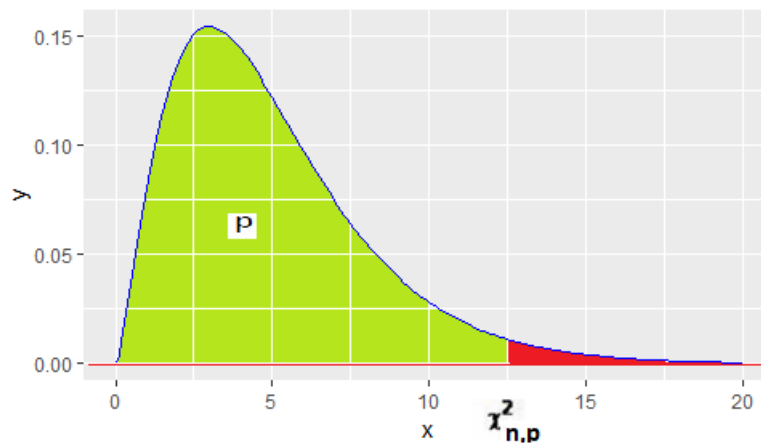
Decimos que $X \sim \chi_k^2$.

Su función de densidad está dada por:

$$f(x;k) = \begin{cases} \dfrac{1}{2^{k/2}\Gamma(k/2)} \, x^{(k/2)-1}e^{-x/2} & \text{para } x > 0, \\ 0 & \text{para } x \leq 0 \end{cases}$$

donde Γ es la función Gamma y k son los grados de libertad de la dist.

$$E(X) = k \quad \text{y} \quad V(X) = 2k$$

También puede considerarse a la distribución χ_k^2 como un caso particular de la distribución Γ, de hecho: $X \sim \Gamma\left(\dfrac{k}{2}, 1/2\right)$.

	p										
k	0.005	0.01	0.025	0.05	0.1	0.9	0.95	0.975	0.99	0.995	0.999
1	0.00004	0.00016	0.00098	0.00393	0.01579	2.706	3.841	5.024	6.635	7.879	10.827
2	0.01	0.0201	0.0506	0.1026	0.2107	4.605	5.991	7.378	9.21	10.597	13.815
3	0.0717	0.1148	0.2158	0.3518	0.5844	6.251	7.815	9.348	11.345	12.838	16.266
4	0.207	0.2971	0.4844	0.7107	1.064	7.779	9.488	11.143	13.277	14.86	18.466
5	0.4118	0.5543	0.8312	1.145	1.61	9.236	11.07	12.832	15.086	16.75	20.515
6	0.6757	0.8721	1.2373	1.635	2.204	10.645	12.592	14.449	16.812	18.548	22.457
7	0.9893	1.239	1.69	2.167	2.833	12.017	14.067	16.013	18.475	20.278	24.321
8	1.344	1.647	2.18	2.733	3.49	13.362	15.507	17.535	20.09	21.955	26.124
9	1.735	2.088	2.7	3.325	4.168	14.684	16.919	19.023	21.666	23.589	27.877
10	2.156	2.558	3.247	3.94	4.865	15.987	18.307	20.483	23.209	25.188	29.588
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.92	24.725	26.757	31.264
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.3	32.909
13	3.565	4.107	5.009	5.892	7.041	19.812	22.362	24.736	27.688	29.819	34.527
14	4.075	4.66	5.629	6.571	7.79	21.064	23.685	26.119	29.141	31.319	36.124
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801	37.698
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32	34.267	39.252
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718	40.791
18	6.265	7.015	8.231	9.39	10.865	25.989	28.869	31.526	34.805	37.156	42.312
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582	43.819
20	7.434	8.26	9.591	10.851	12.443	28.412	31.41	34.17	37.566	39.997	45.314
21	8.034	8.897	10.283	11.591	13.24	29.615	32.671	35.479	38.932	41.401	46.796
22	8.643	9.542	10.982	12.338	14.041	30.813	33.924	36.781	40.289	42.796	48.268
23	9.26	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181	49.728
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.98	45.558	51.179
25	10.52	11.524	13.12	14.611	16.473	34.382	37.652	40.646	44.314	46.928	52.619

k						p					
	0.005	0.01	0.025	0.05	0.1	0.9	0.95	0.975	0.99	0.995	0.999
26	11.16	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.29	54.051
27	11.808	12.878	14.573	16.151	18.114	36.741	40.113	43.195	46.963	49.645	55.475
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.994	56.892
29	13.121	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.335	58.301
30	13.787	14.953	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672	59.702
31	14.458	15.655	17.539	19.281	21.434	41.422	44.985	48.232	52.191	55.002	61.098
32	15.134	16.362	18.291	20.072	22.271	42.585	46.194	49.48	53.486	56.328	62.487
33	15.815	17.073	19.047	20.867	23.11	43.745	47.4	50.725	54.775	57.648	63.869
34	16.501	17.789	19.806	21.664	23.952	44.903	48.602	51.966	56.061	58.964	65.247
35	17.192	18.509	20.569	22.465	24.797	46.059	49.802	53.203	57.342	60.275	66.619
36	17.887	19.233	21.336	23.269	25.643	47.212	50.998	54.437	58.619	61.581	67.985
37	18.586	19.96	22.106	24.075	26.492	48.363	52.192	55.668	59.893	62.883	69.348
38	19.289	20.691	22.878	24.884	27.343	49.513	53.384	56.895	61.162	64.181	70.704
39	19.996	21.426	23.654	25.695	28.196	50.66	54.572	58.12	62.428	65.475	72.055
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766	73.403
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.42	76.154	79.49	86.66
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952	99.608
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215	112.317
80	51.172	53.54	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321	124.839
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299	137.208
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.17	149.449

1.6. Distribución T de Student

Una variable aleatoria tiene distribución t de Student cuando es el resultado del cociente:

$$T = \frac{Z}{\sqrt{V/\nu}}$$

donde:

- Z es una variable aleatoria normal standard.

- V es una variable con distribución χ^2 con ν grados de libertad.

- Z y V son independientes.

La expresión de su función de densidad es:

$$f_T(t) = \frac{\Gamma((\nu+1)/2)}{\sqrt{\nu\pi}\,\Gamma(\nu/2)}(1 + t^2/\nu)^{-(\nu+1)/2} \quad \text{con} \quad t \in \mathbb{R}$$

donde Γ es la función definida por:

$$\Gamma(z) = \int_0^\infty t^{z-1}e^{-t}\,dt$$

- $E(T) = 0$ para $\nu > 1$

- $V(T) = \dfrac{\nu}{\nu - 2}$ para $\nu > 2$ y no está definida en otros casos

- Su gráfica es muy parecida a la de la distribución normal pero con colas más pesadas.

n						F				
	0.6	0.7	0.8	0.9	0.95	0.975	0.99	0.995	0.999	0.9995
1	0.325	0.727	1.376	3.078	6.314	12.706	31.821	63.656	318.289	636.578
2	0.289	0.617	1.061	1.886	2.92	4.303	6.965	9.925	22.328	31.6
3	0.277	0.584	0.978	1.638	2.353	3.182	4.541	5.841	10.214	12.924
4	0.271	0.569	0.941	1.533	2.132	2.776	3.747	4.604	7.173	8.61
5	0.267	0.559	0.92	1.476	2.015	2.571	3.365	4.032	5.894	6.869
6	0.265	0.553	0.906	1.44	1.943	2.447	3.143	3.707	5.208	5.959
7	0.263	0.549	0.896	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.262	0.546	0.889	1.397	1.86	2.306	2.896	3.355	4.501	5.041
9	0.261	0.543	0.883	1.383	1.833	2.262	2.821	3.25	4.297	4.781
10	0.26	0.542	0.879	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.26	0.54	0.876	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.259	0.539	0.873	1.356	1.782	2.179	2.681	3.055	3.93	4.318
13	0.259	0.538	0.87	1.35	1.771	2.16	2.65	3.012	3.852	4.221
14	0.258	0.537	0.868	1.345	1.761	2.145	2.624	2.977	3.787	4.14
15	0.258	0.536	0.866	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.258	0.535	0.865	1.337	1.746	2.12	2.583	2.921	3.686	4.015
17	0.257	0.534	0.863	1.333	1.74	2.11	2.567	2.898	3.646	3.965
18	0.257	0.534	0.862	1.33	1.734	2.101	2.552	2.878	3.61	3.922
19	0.257	0.533	0.861	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.257	0.533	0.86	1.325	1.725	2.086	2.528	2.845	3.552	3.85
21	0.257	0.532	0.859	1.323	1.721	2.08	2.518	2.831	3.527	3.819
22	0.256	0.532	0.858	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.256	0.532	0.858	1.319	1.714	2.069	2.5	2.807	3.485	3.768
24	0.256	0.531	0.857	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.256	0.531	0.856	1.316	1.708	2.06	2.485	2.787	3.45	3.725

n	*F*
	0.6	**0.7**	**0.8**	**0.9**	**0.95**	**0.975**	**0.99**	**0.995**	**0.999**	**0.9995**
26	0.256	0.531	0.856	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.256	0.531	0.855	1.314	1.703	2.052	2.473	2.771	3.421	3.689
28	0.256	0.53	0.855	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.256	0.53	0.854	1.311	1.699	2.045	2.462	2.756	3.396	3.66
30	0.256	0.53	0.854	1.31	1.697	2.042	2.457	2.75	3.385	3.646
40	0.255	0.529	0.851	1.303	1.684	2.021	2.423	2.704	3.307	3.551
41	0.255	0.529	0.85	1.303	1.683	2.02	2.421	2.701	3.301	3.544
42	0.255	0.528	0.85	1.302	1.682	2.018	2.418	2.698	3.296	3.538
43	0.255	0.528	0.85	1.302	1.681	2.017	2.416	2.695	3.291	3.532
44	0.255	0.528	0.85	1.301	1.68	2.015	2.414	2.692	3.286	3.526
45	0.255	0.528	0.85	1.301	1.679	2.014	2.412	2.69	3.281	3.52
46	0.255	0.528	0.85	1.3	1.679	2.013	2.41	2.687	3.277	3.515
47	0.255	0.528	0.849	1.3	1.678	2.012	2.408	2.685	3.273	3.51
48	0.255	0.528	0.849	1.299	1.677	2.011	2.407	2.682	3.269	3.505
49	0.255	0.528	0.849	1.299	1.677	2.01	2.405	2.68	3.265	3.5
50	0.255	0.528	0.849	1.299	1.676	2.009	2.403	2.678	3.261	3.496
60	0.254	0.527	0.848	1.296	1.671	2	2.39	2.66	3.232	3.46
80	0.254	0.526	0.846	1.292	1.664	1.99	2.374	2.639	3.195	3.416
100	0.254	0.526	0.845	1.29	1.66	1.984	2.364	2.626	3.174	3.39
200	0.254	0.525	0.843	1.286	1.653	1.972	2.345	2.601	3.131	3.34
500	0.253	0.525	0.842	1.283	1.648	1.965	2.334	2.586	3.107	3.31

Fórmulas

2.1. Propiedades de conjuntos

2.1.1. Leyes de De Morgan

$$\overline{A \cup B} = \overline{A} \cap \overline{B}$$
$$\overline{A \cap B} = \overline{A} \cup \overline{B}$$

2.2. Combinatoria

Permutaciones S/R $\qquad P_n = n!$

Variaciones S/R $\qquad V_{m,n} = \dfrac{m!}{(m-n)!} \qquad \text{con} \qquad n \leq m$

Combinaciones S/R $\qquad C_{m,n} = \dfrac{V_{m,n}}{P_n} = \dfrac{m!}{(m-n)!n!} \qquad \text{con} \qquad n \leq m$

Permutaciones C/R $\qquad P_n^{k_1,k_2,...,k_r} = \dfrac{n!}{k_1!k_2!...,k_r!} \quad \text{con } k_i \geq 0 \ \text{ y } \ k_1 + k_2 + ... + k_r = n$

Variaciones C/R $\qquad V'm,n = m^n$

2.3. Probabilidades

2.3.1. Teorema de la Suma

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

2.3.2. Probabilidad Condicional

$$P(A/B) = \frac{P(A \cap B)}{P(B)} \qquad \text{con} \qquad P(B) > 0$$

2.4.   Esperanza Varianza y Covarianza

2.4.1.   Definición de Esperanza

Caso discreto: $E(X) = \sum_{x_i \in R_X} x_i p(x_i)$

Caso continuo: $E(X) = \int_{\mathbb{R}} x f(x) dx$

Esperanza de la combinación lineal de variables aleatorias:

$$E(aX + bY) = aE(X) + bE(Y)$$

2.4.2.   Definición de Varianza

$$V(X) = E\left(X - E(X)\right)^2 = E(X^2) - [E(X)]^2$$

2.4.3.   Definición de Covarianza

$$Cov(X,Y) = E\left[(X - E(X))(Y - E(Y))\right] = E(XY) - [E(X)E(Y)]$$

Varianza de la combinación lineal de variables aleatorias:

$$V(aX + bY) = a^2 V(X) + b^2 V(Y) + 2Cov(aX, bY) = a^2 V(X) + b^2 V(Y) + 2ab Cov(X,Y)$$

2.5.   Distribución Bernoulli

$$X \sim Be(p) \Rightarrow P(X = k) = p^k (1-p)^{1-k} \qquad \text{para} \qquad k \in \{0,1\} \qquad \text{con} \qquad 0 < p < 1$$

$$E(X) = p, \qquad V(X) = p(1-p)$$

Sean $X_1, X_2, ..., X_k$ variables aleatorias independientes con distribución Be(p), entonces:

$$Y = X_1 + X_2 + ... + X_k \Rightarrow Y \sim Bi(k, p)$$

2.6.   Distribución Hipergeométrica

Siendo N el tamaño poblacional, R la cantidad de objetos en la población con cierta propiedad y m el tamaño de una muestra extraida de esta población.

$$X \sim \mathcal{H}(N, R, m) \Rightarrow P(k) = \frac{\left(\begin{array}{c} R \\ k \end{array} \right) \left(\begin{array}{c} N - R \\ m - k \end{array} \right)}{\left(\begin{array}{c} N \\ m \end{array} \right)}$$

siendo $\qquad max\left\{0, m + R - N\right\} \leq k \leq min\left\{m, R\right\}$

$$E(X) = m\frac{R}{N} \qquad y \qquad V(X) = m\left(\frac{R}{N}\right)\left(\frac{N-R}{N}\right)\left(\frac{N-m}{N-1}\right)$$

2.7. Distribución Uniforme

$$X \sim U(a,b) \Rightarrow f(x) = \begin{cases} \dfrac{1}{b-a} & si \qquad a < x < b \\ 0 & \text{en otro caso} \end{cases}$$

y

$$F(x) = \begin{cases} 0 & si \qquad x < a \\ \dfrac{x-a}{b-a} & si \qquad a \leq x < b \\ 1 & si \qquad x \geq b \end{cases}$$

$$E(X) = \frac{a+b}{2} \qquad y \qquad V(X) = \frac{(b-a)^2}{12}$$

2.8. Distribución Exponencial

$$X \sim Exp(\lambda) \Rightarrow f(x) = \lambda e^{-\lambda x} \qquad \text{para} \qquad X > 0, \qquad \text{siendo} \qquad \lambda > 0$$

$$F(x) = \begin{cases} 0 & si \qquad x < 0 \\ 1 - e^{-\lambda x} & si \qquad 0 \leq x \end{cases}$$

$$E(X) = 1/\lambda \qquad y \qquad V(X) = 1/\lambda^2$$

2.9. Inferencia

2.9.1. Estadísticos

Siendo $X_1, X_2, ..., X_n$ v.a.i.i.d es decir una muestra aleatoria de una población de interés:

Media Muestral $\quad \overline{X} = \frac{1}{n} \sum_{i=1}^{n} X_i$

Proporción Muestral $\quad \widehat{p} = \dfrac{X}{n}$ donde X es el número de éxitos de la muestra de tamaño n.

Varianza Muestral $\quad S^2 = \dfrac{1}{n-1} \sum_{i=1}^{n} (X_i - \overline{X})^2 = \dfrac{1}{n-1} \left[\sum_{i=1}^{n} X_i^2 - n\overline{X}^2 \right]$

Siendo la muestra ordenada:

$$X^{(1)} \leq X^{(2)} \leq ... \leq X^{(n)}$$

Máximo Muestral

$$X^{(n)} = max\left\{X_1, X_2, ..., X_n\right\}$$

.

Mediana Muestral

$$\begin{cases} \frac{1}{2}\left(X^{(n/2)+1} + X^{(n/2)}\right) & \text{cuando n es par} \\ X^{(n+1/2)} & \text{cuando n es impar} \end{cases}$$

Rango Muestral $\quad rg = X^{(n)} - X^{(1)}$

2.9.2. Distribución de los Estimadores

2.9.2.1. Media muestral Población Normal con Varianza Conocida

$X_1, X_2, ..., X_n$ v.a.i.i.d $X_i \sim N(\mu, \sigma^2)$ y σ es conocida, entonces:

$$\overline{X} \sim N(\mu, \frac{\sigma^2}{n})$$

2.9.2.2. Media muestral Población Normal con Varianza Desconocida

$X_1, X_2, ..., X_n$ v.a.i.i.d $X_i \sim N(\mu, \sigma^2)$ y σ es desconocida, entonces:

$$\frac{\overline{X} - \mu}{s/\sqrt{n}} \sim t_{n-1}$$

2.9.2.3. Media muestral Población cualquiera (n >30)

$X_1, X_2, ..., X_n$ v.a.i.i.d $E(X_i) = \mu$ y $V(X_i) = \sigma^2$ ambas desconocidas, entonces:

$$\frac{\overline{X} - \mu}{s/\sqrt{n}} \xrightarrow{d} N(0;1)$$

2.9.2.4. Varianza muestral Población Normal

$X_1, X_2, ..., X_n$ v.a.i.i.d $X_i \sim N(\mu, \sigma^2)$, entonces:

$$\frac{(n-1)S^2}{\sigma^2} \sim \chi^2_{n-1}$$

2.9.2.5. Proporción muestral (n >30)

$X_1, X_2, ..., X_n$ v.a.i.i.d $X_i \sim Be(p)$ entonces:

$$\widehat{P} \xrightarrow{d} N\left(p, \frac{p(1-p)}{n}\right)$$

2.9.2.6. Diferencias de medias muestrales Poblaciones Normales con Varianzas Conocidas

Siendo $X_1, X_2, ..., X_{n_1}$ v.a.i.i.d $X_i \sim N(\mu_1, \sigma_1^2)$ y $Y_1, Y_2, ..., Y_{n_2}$ v.a.i.i.d $Y_i \sim N(\mu_2, \sigma_2^2)$ con σ_1 y σ_2 conocidas; dos muestras independientes, entonces:

$$\overline{X}_1 - \overline{X}_2 \sim N\left(\mu_1 - \mu_2, \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}\right)$$

2.9.2.7. Diferencias de medias muestrales Poblaciones Normales con Varianzas Desconocidas

Siendo $X_1, X_2, ..., X_{n_1}$ v.a.i.i.d $X_i \sim N(\mu_1, \sigma_1^2)$ y $Y_1, Y_2, ..., Y_{n_2}$ v.a.i.i.d $Y_i \sim N(\mu_2, \sigma_2^2)$ con σ_1 y σ_2 desconocidas pero iguales, dos muestras independientes; entonces:

$$\frac{\overline{X}_1 - \overline{X}_2 - (\mu_1 - \mu_2)}{S_p\sqrt{1/n_1 + 1/n_2}} \sim t_{n_1+n_2-2}$$

siendo S_p^2 la varianza amalgamada de ambas muestras, definida por:

$$S_p^2 = \frac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{n_1 + n_2 - 2}$$

2.9.2.8. Diferencia de proporciones muestrales ($n_1 > 30$ y $n_2 > 30$)

Siendo $X_1, X_2, ..., X_{n_1}$ v.a.i.i.d $X_i \sim Be(p_1)$ y $Y_1, Y_2, ..., Y_{n_2}$ v.a.i.i.d $Y_i \sim Be(p_2)$ dos muestras independientes, siendo $\mathbb{X} = \sum_{i=1}^{n_1} X_i$ e $\mathbb{Y} = \sum_{i=1}^{n_2} Y_i$ $\widehat{p}_1 = \frac{\mathbb{X}}{n_1}$ y $\widehat{p}_2 = \frac{\mathbb{Y}}{n_2}$ entonces :

$$\widehat{p}_1 - \widehat{p}_2 \xrightarrow{d} N\left(p_1 - p_2, \frac{p_1(1-p_1)}{n_1} + \frac{p_2(1-p_2)}{n_2}\right)$$

Suponiendo $p_1 = p_2 = p$ iguales, se puede utilizar una estimación conjunta de p:

$$\widehat{p} = \frac{\mathbb{X} + \mathbb{Y}}{n_1 + n_2}$$

entonces:

$$\widehat{p}_1 - \widehat{p}_2 \xrightarrow{d} N\left(0, \widehat{p}(1-\widehat{p})\left\{\frac{1}{n_1} + \frac{1}{n_2}\right\}\right)$$

Regresión Lineal Simple

3.1. Modelo

$$Y_i = \alpha + \beta X_i + \epsilon_i, \qquad 1 \le i \le n \qquad \epsilon_i \text{ independientes y } \epsilon_i \sim N(0, \sigma^2)$$

3.2. Sumas de Cuadrados

Suma de Cuadrados Totales: $\quad SCT = S_{yy} = \sum_{i=1}^{n} (y_i - \overline{y})^2 = \sum_{i=1}^{n} y_i^2 - n\overline{y}^2$

Suma de Cuadrados Explicados: $\quad SCE = \dfrac{\left(\sum_{i=1}^{n} x_i y_i - n\overline{x}.\overline{y} \right)^2}{\sum_{i=1}^{n} x_i^2 - n\overline{x}^2} = \dfrac{S_{xy}^2}{S_{xx}}$

Suma de Cuadrados Residuales: $\quad SCR = SCT - SCE$

3.3. Estimación de parámetros

$$\widehat{\alpha} = a = \overline{y} - b\overline{x}$$

$$\widehat{\beta} = b = \frac{S_{xy}}{S_{xx}} \qquad b \sim N\left(\beta, \frac{\sigma^2}{S_{xx}} \right) \qquad \Rightarrow \qquad \frac{b - \beta}{S_e / \sqrt{S_{xx}}} \sim t_{n-2}$$

$$\widehat{\sigma}_{\epsilon}^2 = s_e^2 = \sum_{i=1}^{n} \frac{e_i^2}{n-2} = \sum_{i=1}^{n} \frac{(y_i - \widehat{y}_i)^2}{n-2} = \frac{1}{n-2} [SCT - SCE]$$

3.4. Coeficientes de Correlación Lineal y Determinación

Coeficiente de Correlación lineal

$$(X, Y) \sim N(\mu_1, \mu_2, \sigma_1, \sigma_2, \rho) \Rightarrow \widehat{\rho} = r = \frac{S_{xy}}{\sqrt{S_{xx}.S_{yy}}}$$

Luego

$$T = \frac{r.\sqrt{n-2}}{\sqrt{1-r^2}} \sim t_{n-2}$$

Coeficiente de Determinación

$$R^2 = 1 - \frac{SCR}{SCT} = r^2$$

3.5. IC para el valor medio de la variable respuesta, condicionado a un valor de X

Sea $x_0 \in R_X$, e $\widehat{y}_0 = a + bx_0$ entonces:

$$\widehat{y}_0 \pm t_{n-2,1-\alpha/2} S_e \sqrt{\frac{1}{n} + \frac{(x_0 - \overline{x})^2}{S_{xx}}}$$

3.6. IP para un valor de respuesta condicionado a un valor de X

Sea $x_0 \in R_X$, e $\widehat{y}_0 = a + bx_0$ entonces:

$$\widehat{y}_0 \pm t_{n-2,1-\alpha/2} S_e \sqrt{1 + \frac{1}{n} + \frac{(x_0 - \overline{x})^2}{S_{xx}}}$$