

## Estadística Descriptiva

Métrica	Individuales	Agrupados
Media	$\bar{x} = \frac{1}{n} \sum_{k=0}^n x_k$	$\bar{x} = \frac{1}{n} \sum_{j=1}^k f_j \cdot x_j$
Mediana	$\tilde{x} = \begin{cases} x_{\frac{n+1}{2}} & n \text{ es impar} \\ \frac{x_{\frac{n}{2}} + x_{\frac{n}{2}+1}}{2} & n \text{ es par} \end{cases}$	$\tilde{x} = L + \frac{\frac{n}{2} - F}{f} \cdot w$
Varianza	$s^2 = \frac{1}{n-1} \sum_{k=1}^n (x_k - \bar{x})^2$	$s^2 = \frac{1}{n-1} \sum_{j=1}^k f_j \cdot (x_j - \bar{x})^2$
Desviación estándar	$s = \sqrt{s^2}$	$s = \sqrt{s^2}$
Percentiles	$P_{100p} = \begin{cases} \frac{x_{np} + x_{np+1}}{2} & np \in \mathbb{Z} \\ x_{[np]} & np \notin \mathbb{Z} \end{cases}$	$P_{100p} = L + \frac{np - F}{f} \cdot w$

Rango	$x_{\max} - x_{\min}$
Rango intercuartil	$RIQ = Q_3 - Q_1$
Coefficiente de variación	$V = \frac{s}{\bar{x}}$
Covarianza	$\text{Cov}(x, y) = \frac{1}{n-1} \sum_{k=1}^n (x_k - \bar{x})(y_k - \bar{y})$
Coefficiente de relación	$r = \frac{\text{Cov}(x, y)}{s_x s_y}$
Asimetría	$\frac{1}{ns^3} \sum_{k=1}^n (x_k - \bar{x})^3$
Curtosis	$\frac{1}{ns^4} \sum_{k=1}^n (x_k - \bar{x})^4$

## Probabilidad de eventos

$P(A) = \frac{\text{Casos Favorables}}{\text{Casos Totales}}$	$P(A \cap B) = P(A)P(B)$ , independientes
Probabilidad de la unión eventos	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ $P\left(\bigcup_{k=1}^n A_k\right) = \sum_{k=1}^n P(A_k)$ , disjuntos
Probabilidad Condicional	$P(B A) = \frac{P(A \cap B)}{P(A)}$
Probabilidad Total	$P(A) = \sum_{k=1}^n P(A B_k)P(B_k)$
Teorema de Bayes	$P(B_k A) = \frac{P(A B_k)P(B_k)}{\sum_{k=1}^n P(A B_k)P(B_k)}$

## Análisis Combinatorio

conjunto tipo $\{a, b, c, d\}$	Sin repetición	Con Repetición
Con orden	$nCk = \frac{n!}{(n-k)!k!}$	$nCRk = \frac{(n+k-1)!}{(n-1)!k!}$
Sin orden	$nPk = \frac{n!}{(n-k)!}$	$nPRk = n^k$
conjunto tipo $\{a, a, a, b, b, b, c, c, d, d\}$	$nPN_1, n_2, \dots, n_k = \frac{n!}{\prod_{j=1}^k n_j!}$ , donde $\sum_{j=1}^k n_j = n$	

Continua			Discreta		
Propiedades	$P(X \leq x)$	Media y varianza	Propiedades	$P(X \leq x)$	Media y varianza
$f(x) \geq 0$	$\int_{-\infty}^x f(t)dt$	$\mu = E(X) = \int_{-\infty}^{+\infty} x f(x)dx$	$p(x) \geq 0$	$\sum_{k=0}^x p_k$	$\mu = E(X) = \sum_{k=0}^n x_k p_k$
$\int_{-\infty}^{+\infty} f(x)dx = 1$		$\sigma^2 = V(X) = \int_{-\infty}^{+\infty} (x - \mu)^2 f(x)dx$	$\sum_{k=0}^n p(k) = 1$		$\sigma^2 = V(X) = \sum_{k=0}^n (x_k - \mu)^2 p_k$

Leyes de Probabilidad	Función $P(X = x)$	Esperanza	Varianza	Asimetría	Curtosis
Binomial	$\binom{n}{x} p^x (1-p)^{n-x}$	$np$	$np(1-p)$	$\frac{1-2p}{\sqrt{np(1-p)}}$	$3 + \frac{1-6p(1-p)}{np(1-p)}$
Hipergeométrica	$\frac{\binom{a}{x} \binom{N-a}{n-x}}{\binom{N}{n}}$	$\frac{an}{N}$	$np(1-p) \frac{N-n}{N-1}$	$\frac{(N-2a)(N-2n)\sqrt{N-1}}{(n-2)\sqrt{na(N-a)(N-n)}}$	
Poisson	$\frac{e^{-\lambda} \lambda^x}{x!}$	$\lambda$	$\lambda$	$\frac{1}{\sqrt{\lambda}}$	$3 + \frac{1}{\lambda}$
Binomial negativa	$\binom{x-1}{k-1} p^k q^{x-k}$	$\frac{k}{p}$	$\frac{k(1-p)}{p^2}$	$\frac{2-p}{\sqrt{k(1-p)}}$	$3 + \frac{p^2 - 6p + 6}{k(1-p)}$
Geométrica	$p(1-p)^{x-1}$	$\frac{1}{p}$	$\frac{1-p}{p^2}$	$\frac{2-p}{\sqrt{1-p}}$	$3 + \frac{p^2 - 6p + 6}{1-p}$
Uniforme	$\begin{cases} \frac{1}{b-a} & a \leq x \leq b \\ 0 & \text{otro caso} \end{cases}$	$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$	0	$\frac{9}{5}$
Gamma	$\begin{cases} \frac{1}{\beta^\alpha \Gamma(\alpha)} x^{\alpha-1} \exp\left(-\frac{x}{\beta}\right) & x > 0 \\ 0 & \text{otro caso} \end{cases}$	$\alpha\beta$	$\alpha\beta^2$	$\frac{2}{\sqrt{\alpha}}$	$3 \left(1 + \frac{2}{\alpha}\right)$
Exponencial	$\begin{cases} \frac{1}{\beta} \exp\left(-\frac{x}{\beta}\right) & x > 0 \\ 0 & \text{otro caso} \end{cases}$	$\beta$	$\beta^2$	2	9
Normal	$\frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right)$	$\mu$	$\sigma^2$	0	3
Chi Cuadrada	$\begin{cases} \frac{1}{2^{\frac{v}{2}} \Gamma(\frac{v}{2})} x^{\frac{v}{2}-1} e^{-\frac{x}{2}} & x > 0 \\ 0 & \text{otro caso} \end{cases}$	$v$	$2v$	$\sqrt{\frac{8}{v}}$	$\frac{12}{v}$

**Teorema Central del Límite:** Sean  $X_1, X_2, \dots, X_n$ ;  $n$  variables aleatorias independientes con media  $\mu$  y varianza  $\sigma^2$ , (con cualquier distribución de probabilidad) entonces, la **variable promedio**  $\bar{X} = \frac{1}{n} \sum_{k=1}^n X_k$  tiene media  $\mu$  y desviación estándar  $\frac{\sigma}{\sqrt{n}}$  y tiende a una ley

normal de probabilidades conforme  $n$  tiende al infinito. La variable estandarizada:  $Z = \frac{(\bar{X} - \mu)\sqrt{n}}{\sigma}$  converge a una ley normal estándar.

**Resultado:** Siendo  $X$  variable aleatoria Binomial. La variable  $Y = \frac{X - np}{\sqrt{npq}}$  converge a la ley normal estandarizada. **Distribuciones de muestreo de las variables media, total y proporción**

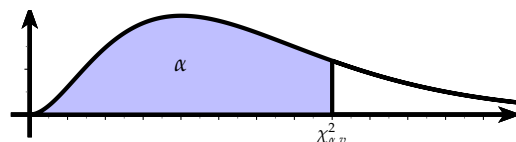
Variable	Varianza de la población conocida		Varianza de la población desconocida (Estimada)	
	Tamaño de la Población $N$	Población infinita	Tamaño de la Población $N$	Población infinita
Media $\bar{X} = \frac{\sum_{k=1}^n X_k}{n}$ $E(\bar{X}) = \mu$	$V(\bar{X}) = \frac{\sigma^2(N-n)}{n(N-1)}$	$V(\bar{X}) = \frac{\sigma^2}{n}$	$\hat{V}(\bar{X}) = \frac{s^2(N-n)}{nN}$	$\hat{V}(\bar{X}) = \frac{s^2}{n}$
Total $T = n\bar{X}$ $E(T) = n\mu$	$V(T) = n\sigma^2 \frac{(N-n)}{(N-1)}$	$V(T) = n\sigma^2$	$\hat{V}(T) = ns^2 \frac{(N-n)}{N}$	$\hat{V}(T) = ns^2$
Proporción $P = \frac{X}{n}$ $E(P) = p$	$V(P) = \frac{pq(N-n)}{n(N-1)}$	$V(P) = \frac{pq}{n}$	$\hat{V}(P) = \frac{\hat{p}\hat{q}(N-n)}{N(n-1)}$	$\hat{V}(P) = \frac{\hat{p}\hat{q}}{n}$

**Intervalos de confianza**

Media	Varianza poblacional conocida ( $\sigma^2$ )	$\bar{X} - z_{1-\frac{\alpha}{2}} \sqrt{V(\bar{X})} < \mu < \bar{X} + z_{1-\frac{\alpha}{2}} \sqrt{V(\bar{X})}$
$\mu$	Varianza muestral conocida ( $s^2$ )	$\bar{X} - t_{1-\frac{\alpha}{2}, n-1} \sqrt{\hat{V}(\bar{X})} < \mu < \bar{X} + t_{1-\frac{\alpha}{2}, n-1} \sqrt{\hat{V}(\bar{X})}$
Proporción	Varianza poblacional conocida ( $\sigma^2$ )	$P - z_{1-\frac{\alpha}{2}} \sqrt{V(P)} < p < P + z_{1-\frac{\alpha}{2}} \sqrt{V(P)}$
$p$	Varianza muestral conocida ( $s^2$ )	$P - z_{1-\frac{\alpha}{2}} \sqrt{\hat{V}(P)} < p < P + z_{1-\frac{\alpha}{2}} \sqrt{\hat{V}(P)}$
Varianza $\sigma^2$	$\frac{(n-1)s^2}{\chi^2_{1-\frac{\alpha}{2}}} < \sigma^2 < \frac{(n-1)s^2}{\chi^2_{\frac{\alpha}{2}}}$	
$z_{1-\frac{\alpha}{2}} = 1,64$ al 90 % confianza, $z_{1-\frac{\alpha}{2}} = 1,96$ al 95 % confianza, $z_{1-\frac{\alpha}{2}} = 2,58$ al 99 % confianza		

**Pruebas de Hipótesis**

Media	Proporción	Bondad de Ajuste	Varianza
$t = \frac{\bar{x} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$	$z = \frac{ P - P_0  - \frac{1}{2n}}{\sqrt{\frac{P_0 Q_0}{n}}}$	$\chi^2 = \sum_{j=1}^k \frac{(O_j - e_j)^2}{e_j}$	$\chi^2 = \frac{(n-1)s^2}{\sigma_0^2}$



$\alpha$	0.0005	0.001	0.0025	0.005	0.010	0.025	0.050	0.100	0.150	0.200	0.250	0.300	0.350	0.400	0.450	0.500	0.550	0.600	0.650	0.700	0.750	0.800	0.850	0.900	0.950	0.975	0.990	0.995	0.998	0.999	0.9995
1	0.000	0.000	0.000	0.000	0.000	0.001	0.004	0.016	0.036	0.064	0.102	0.148	0.206	0.275	0.357	0.455	0.571	0.708	0.873	1.074	1.323	1.642	2.072	2.706	3.841	5.024	6.635	7.879	9.141	10.83	12.12
2	0.001	0.002	0.005	0.010	0.020	0.051	0.103	0.211	0.325	0.446	0.575	0.713	0.862	1.022	1.196	1.386	1.597	1.833	2.100	2.408	2.773	3.219	3.794	4.606	5.992	7.379	9.214	10.60	12.00	13.85	15.27
3	0.015	0.024	0.045	0.072	0.115	0.216	0.352	0.584	0.798	1.005	1.213	1.424	1.642	1.869	2.109	2.366	2.643	2.946	3.283	3.665	4.108	4.642	5.317	6.251	7.815	9.348	11.34	12.84	14.32	16.27	17.73
4	0.064	0.091	0.145	0.207	0.297	0.484	0.711	1.064	1.366	1.649	1.923	2.195	2.470	2.753	3.047	3.357	3.687	4.045	4.438	4.878	5.385	5.989	6.745	7.779	9.488	11.14	13.28	14.84	16.42	18.47	20.00
5	0.158	0.210	0.307	0.412	0.554	0.831	1.145	1.610	1.994	2.343	2.675	3.000	3.325	3.655	3.996	4.351	4.728	5.132	5.573	6.064	6.626	7.289	8.115	9.236	11.07	12.83	15.09	16.75	18.39	20.52	22.11
6	0.299	0.381	0.527	0.676	0.872	1.237	1.635	2.204	2.661	3.070	3.455	3.828	4.197	4.570	4.952	5.348	5.765	6.211	6.695	7.231	7.841	8.558	9.446	10.64	12.59	14.45	16.81	18.55	20.25	22.46	24.10
7	0.485	0.598	0.794	0.989	1.239	1.690	2.167	2.833	3.358	3.822	4.255	4.671	5.082	5.493	5.913	6.346	6.800	7.283	7.806	8.383	9.037	9.803	10.75	12.02	14.07	16.01	18.48	20.28	22.04	24.32	26.02
8	0.710	0.857	1.104	1.344	1.646	2.180	2.733	3.490	4.078	4.594	5.071	5.527	5.975	6.423	6.877	7.344	7.833	8.351	8.909	9.524	10.22	11.03	12.03	13.36	15.51	17.53	20.09	21.95	23.77	26.12	27.87
9	0.972	1.152	1.450	1.735	2.088	2.700	3.325	4.168	4.817	5.380	5.899	6.393	6.876	7.357	7.843	8.343	8.863	9.414	10.01	10.66	11.39	12.24	13.29	14.68	16.92	19.02	21.67	23.59	25.46	27.88	29.67
10	1.265	1.479	1.827	2.156	2.558	3.247	3.940	4.865	5.570	6.179	6.737	7.267	7.783	8.295	8.812	9.342	9.892	10.47	11.10	11.78	12.55	13.44	14.53	15.99	18.31	20.48	23.21	25.19	27.11	29.59	31.42
11	1.587	1.834	2.232	2.603	3.053	3.816	4.575	5.578	6.336	6.989	7.584	8.148	8.695	9.237	9.783	10.34	10.92	11.53	12.18	12.90	13.70	14.63	15.77	17.28	19.68	21.92	24.72	26.76	28.73	31.26	33.14
12	1.934	2.214	2.661	3.074	3.571	4.404	5.226	6.304	7.114	7.807	8.438	9.034	9.612	10.18	10.76	11.34	11.95	12.58	13.27	14.01	14.85	15.81	16.99	18.55	21.03	23.34	26.22	28.30	30.32	32.91	34.82
13	2.305	2.617	3.112	3.565	4.107	5.009	5.892	7.042	7.901	8.634	9.299	9.926	10.53	11.13	11.73	12.34	12.97	13.64	14.35	15.12	15.98	16.98	18.20	19.81	22.36	24.74	27.69	29.82	31.88	34.53	36.48
14	2.697	3.041	3.582	4.075	4.660	5.629	6.571	7.790	8.696	9.467	10.17	10.82	11.45	12.08	12.70	13.34	14.00	14.69	15.42	16.22	17.12	18.15	19.41	21.06	23.68	26.12	29.14	31.32	33.43	36.12	38.11
15	3.108	3.483	4.070	4.601	5.229	6.262	7.261	8.547	9.499	10.31	11.04	11.72	12.38	13.03	13.68	14.34	15.02	15.73	16.49	17.32	18.25	19.31	20.60	22.31	25.00	27.49	30.58	32.80	34.95	37.70	39.72
16	3.536	3.942	4.573	5.142	5.812	6.908	7.962	9.312	10.31	11.15	11.91	12.62	13.31	13.98	14.66	15.34	16.04	16.78	17.56	18.42	19.37	20.47	21.79	23.54	26.30	28.85	32.00	34.27	36.46	39.25	41.31
17	3.980	4.416	5.092	5.697	6.408	7.564	8.672	10.09	11.12	12.00	12.79	13.53	14.24	14.94	15.63	16.34	17.06	17.82	18.63	19.51	20.49	21.61	22.98	24.77	27.59	30.19	33.41	35.72	37.95	40.79	42.88
18	4.439	4.905	5.623	6.265	7.015	8.231	9.390	10.86	11.95	12.86	13.68	14.44	15.17	15.89	16.61	17.34	18.09	18.87	19.70	20.60	21.60	22.76	24.16	25.99	28.87	31.53	34.81	37.16	39.42	42.31	44.43
19	4.912	5.407	6.167	6.844	7.633	8.907	10.12	11.65	12.77	13.72	14.56	15.35	16.11	16.85	17.59	18.34	19.11	19.91	20.76	21.69	22.72	23.90	25.33	27.20	30.14	32.85	36.19	38.58	40.88	43.82	45.97
20	5.398	5.921	6.723	7.434	8.260	9.591	10.85	12.44	13.60	14.58	15.45	16.27	17.05	17.81	18.57	19.34	20.13	20.95	21.83	22.77	23.83	25.04	26.50	28.41	31.41	34.17	37.57	40.00	42.34	45.31	47.50
21	5.896	6.447	7.289	8.034	8.897	10.28	11.59	13.24	14.44	15.44	16.34	17.18	17.98	18.77	19.55	20.34	21.15	21.99	22.89	23.86	24.93	26.17	27.66	29.62	32.67	35.48	38.93	41.40	43.78	46.80	49.01
22	6.404	6.983	7.865	8.643	9.542	10.98	12.34	14.04	15.28	16.31	17.24	18.10	18.92	19.73	20.53	21.34	22.17	23.03	23.95	24.94	26.04	27.30	28.82	30.81	33.92	36.78	40.29	42.80	45.20	48.27	50.51
23	6.924	7.529	8.450	9.260	10.20	11.69	13.09	14.85	16.12	17.19	18.14	19.02	19.87	20.69	21.51	22.34	23.19	24.07	25.01	26.02	27.14	28.43	29.98	32.01	35.17	38.08	41.64	44.18	46.62	49.73	52.00
24	7.453	8.085	9.044	9.886	10.86	12.40	13.85	15.66	16.97	18.06	19.04	19.94	20.81	21.65	22.49	23.34	24.20	25.11	26.06	27.10	28.24	29.55	31.13	33.20	36.42	39.36	42.98	45.56	48.03	51.18	53.48
25	7.991	8.649	9.646	10.52	11.52	13.12	14.61	16.47	17.82	18.94	19.94	20.87	21.75	22.62	23.47	24.34	25.22	26.14	27.12	28.17	29.34	30.68	32.28	34.38	37.65	40.65	44.31	46.93	49.44	52.62	54.95
26	8.538	9.222	10.26	11.16	12.20	13.84	15.38	17.29	18.67	19.82	20.84	21.79	22.70	23.58	24.45	25.34	26.24	27.18	28.17	29.25	30.43	31.79	33.43	35.56	38.89	41.92	45.64	48.29	50.83	54.05	56.41
27	9.093	9.803	10.87	11.81	12.88	14.57	16.15	18.11	19.53	20.70	21.75	22.72	23.64	24.54	25.44	26.34	27.26	28.21	29.23	30.32	31.53	32.91	34.57	36.74	40.11	43.19	46.96	49.64	52.22	55.48	57.86
28	9.656	10.39	11.50	12.46	13.56	15.31	16.93	18.94	20.39	21.59	22.66	23.65	24.59	25.51	26.42	27.34	28.27	29.25	30.28	31.39	32.62	34.03	35.71	37.92	41.34	44.46	48.28	50.99	53.59	56.89	59.30
29	10.23	10.99	12.13	13.12	14.26	16.05	17.71	19.77	21.25	22.48	23.57	24.58	25.54	26.48	27.40	28.34	29.29	30.28	31.33	32.46	33.71	35.14	36.85	39.09	42.56	45.72	49.59	52.34	54.97	58.30	60.73
30	10.80	11.59	12.76	13.79	14.95	16.79	18.49	20.60	22.11	23.36	24.48	25.51	26.49	27.44	28.39	29.34	30.31	31.32	32.38	33.53	34.80	36.25	37.99	40.26	43.77	46.98	50.89	53.67	56.33	59.70	62.16
35	13.79	14.69	16.03	17.19	18.51	20.57	22.47	24.80	26.46	27.84	29.05	30.18	31.25	32.28	33.31	34.34	35.39	36.47	37.62	38.86	40.22	41.78	43.64	46.06	49.80	53.20	57.34	60.27	63.08	66.62	69.20
40	16.91	17.92	19.42	20.71	22.16	24.43	26.51	29.05	30.86	32.34	33.66	34.87	36.02	37.13	38.23	39.34	40.														