

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	$\tilde{x} = \begin{cases} x_{\frac{n+1}{2}} & n \text{ es impar} \\ \frac{x_{\frac{n}{2}} + x_{\frac{n}{2}+1}}{2} & n \text{ es par} \end{cases}$	$\tilde{x} = L_{i-1} + \frac{\frac{n}{2} - F_{i-1}}{f_i} A$
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	$P_k = \begin{cases} \frac{x_j + x_{j+1}}{2} & r = 0 \\ x_{[j+1]} & r > 0 \end{cases}$	$\frac{P_k}{\frac{nk/100 - F_{k-1}}{f_k} A} = L_{k-1} +$

Rango	$x_{\max} - x_{\min}$
Rango intercuartil	$RIQ = Q_3 - Q_1$
Coefficiente de variación	$CV = \frac{s}{\bar{x}}$
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	$A_s = \frac{1}{ns^3} \sum_{k=1}^n (x_k - \bar{x})^3$
Curtosis	$A_c = \frac{1}{ns^4} \sum_{k=1}^n (x_k - \bar{x})^4$

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	$n\text{C}k = \frac{n!}{(n-k)!k!}$	$n\text{CR}k = \frac{(n+k-1)!}{(n-1)!k!}$
Sin orden	$n\text{P}k = \frac{n!}{(n-k)!}$	$n\text{PR}k = n^k$
conjunto tipo $\{a, a, a, b, b, b, c, c, d, d\}$ $n\text{P}n_1, n_2, \dots, n_k = \frac{n!}{\prod_{j=1}^k n_j!}$, 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
$f(x) \geq 0$	$\int_{-\infty}^x f(t)dt$	$\mu = E(X) = \int_{-\infty}^{+\infty} xf(x)dx$	$p(x) \geq 0$	$\sum_{k=0}^x p_k$	$\mu = E(X) = \sum_{k=0}^n x_k p_k$
$\int_{-\infty}^{+\infty} f(x)dx = 1$		$\sigma^2 = V(X) = \int_{-\infty}^{+\infty} (x - \mu)^2 f(x)dx$	$\sum_{k=0}^n p(k) = 1$		$\sigma^2 = V(X) = \sum_{k=0}^n (x_k - \mu)^2 p_k$

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	$\frac{e^{-\lambda} \lambda^x}{x!}$		λ		λ	$\frac{1}{\sqrt{\lambda}}$	$3 + \frac{1}{\lambda}$
Binomial negativa	$\binom{x - 1}{k - 1} p^k q^{x - k}$	$\binom{x + k - 1}{k - 1} p^k q^x$	$\frac{k}{p}$	$\frac{qk}{p}$	$\frac{k(1 - p)}{p^2}$	$\frac{2 - p}{\sqrt{k(1 - p)}}$	$3 + \frac{p^2 - 6p + 6}{k(1 - p)}$
Geométrica	$p(1 - p)^{x - 1}$	$p(1 - p)^x$	$\frac{1}{p}$	$\frac{q}{p}$	$\frac{1 - p}{p^2}$	$\frac{2 - p}{\sqrt{1 - p}}$	$3 + \frac{p^2 - 6p + 6}{1 - p}$
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	$\begin{cases} \frac{1}{\beta} \exp\left(-\frac{x}{\beta}\right) & x > 0 \\ 0 & \text{otro caso} \end{cases}$		β		β^2	2	9
Normal	$\frac{1}{\sqrt{2\pi}\sigma} \exp\left(-\frac{(x - \mu)^2}{2\sigma^2}\right)$		μ		σ^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 μ y varianza σ^2 , (con cualquier distribución de probabilidad) entonces, la **variable promedio** $\bar{X} = \frac{1}{n} \sum_{k=1}^n X_k$ tiene media μ 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

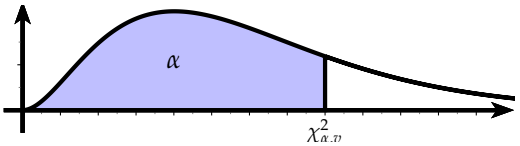
Variable	Varianza de la población conocida		Varianza de la población desconocida (Estimada)	
	Tamaño de la Población N	Población infinita	Tamaño de la Población N	Población infinita
Media $\bar{X} = \frac{\sum_{k=1}^n X_k}{n}$ $E(\bar{X}) = \mu$	$V(\bar{X}) = \frac{\sigma^2(N-n)}{n(N-1)}$	$V(\bar{X}) = \frac{\sigma^2}{n}$	$\hat{V}(\bar{X}) = \frac{s^2(N-n)}{nN}$	$\hat{V}(\bar{X}) = \frac{s^2}{n}$
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 (σ^2)	$\bar{X} - z_{1-\frac{\alpha}{2}}\sqrt{V(\bar{X})} < \mu < \bar{X} + z_{1-\frac{\alpha}{2}}\sqrt{V(\bar{X})}$
μ	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 (σ^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 σ^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
$t = \frac{\bar{x} - \mu_0}{\frac{\sigma}{\sqrt{n}}}$	$z = \frac{ P - P_0 - \frac{1}{2n}}{\sqrt{\frac{P_0Q_0}{n}}}$	$\chi^2 = \sum_{j=1}^k \frac{(O_j - e_j)^2}{e_j}$	$\chi^2 = \frac{(n-1)s^2}{\sigma_0^2}$



$\alpha \backslash v$	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	14.86	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	10.342	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	40.46	41.62	42.85	44.16	45.62	47.27	49.24	51.81	55.76	59.34	63.69	66.77	69.70	73.40	76.09
45	20.14	21.25	22.90	24.31	25.90	28.37	30.61	33.35	35.29	36.88	38.29	39.58	40.81	42.00	43.16	44.34	45.53	46.76	48.06	49.45	50.98	52.73	54.81	57.51	61.66	65.41	69.96	73.17	76.22	80.08	82.88
50	23.46	24.67	26.46	27.99	29.71	32.36	34.76	37.69	39.75	41.45	42.94	44.31	45.61	46.86	48.10	49.33	50.59	51.89	53.26	54.72	56.33	58.16	60.35	63.17	67.50	71.42	76.15	79.49	82.66	86.66	89.56
55	26.87	28.17	30.10	31.73	33.57	36.40	38.96	42.06	44.24	46.44	48.74	51.06	53.40	55.72	58.06	60.42	62.78	65.15	67.52	69.89	72.26	74.63	77.00	79.37	83.84	87.87	91.91	95.95	99.93	103.97	107.96
60	30.34	31.74	33.79	35.53	37.48	40.48	43.19	46.46	48.76	50.64	52.29	53.81	55.24	56.62	57.98	59.33	60.71	62.1													

Probabilidad y Estadística

		$f_{0.05}(v_n, v_d)$																														
v_n	v_d	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
1	1	161.448	18.513	10.128	7.709	6.608	5.987	5.591	5.318	5.117	4.965	4.844	4.747	4.667	4.600	4.543	4.494	4.451	4.414	4.381	4.351	4.325	4.301	4.279	4.260	4.242	4.225	4.210	4.196	4.183	4.171	
2	199.500	19.000	9.552	6.944	5.786	5.143	4.737	4.459	4.256	4.103	3.982	3.885	3.806	3.739	3.682	3.634	3.592	3.555	3.522	3.493	3.467	3.443	3.422	3.403	3.385	3.369	3.354	3.340	3.328	3.316		
3	215.707	19.164	9.277	6.591	5.409	4.757	4.347	4.066	3.863	3.708	3.587	3.490	3.411	3.344	3.287	3.239	3.197	3.160	3.127	3.098	3.072	3.049	3.028	3.009	2.991	2.975	2.960	2.947	2.934	2.922		
4	224.583	19.247	9.117	6.388	5.192	4.534	4.120	3.838	3.633	3.478	3.357	3.259	3.179	3.112	3.056	3.007	2.965	2.928	2.895	2.866	2.840	2.817	2.796	2.776	2.759	2.743	2.728	2.714	2.701	2.690		
5	230.162	19.296	9.013	6.256	5.050	4.387	3.972	3.687	3.482	3.326	3.204	3.106	3.025	2.958	2.901	2.852	2.810	2.773	2.740	2.711	2.685	2.661	2.640	2.621	2.603	2.587	2.572	2.558	2.545	2.534		
6	233.986	19.330	8.941	6.163	4.950	4.284	3.866	3.581	3.374	3.217	3.095	2.996	2.915	2.848	2.790	2.741	2.699	2.661	2.628	2.599	2.573	2.549	2.528	2.508	2.490	2.474	2.459	2.445	2.432	2.421		
7	236.768	19.353	8.887	6.094	4.876	4.207	3.787	3.500	3.293	3.135	3.012	2.913	2.832	2.764	2.707	2.657	2.614	2.577	2.544	2.514	2.488	2.464	2.442	2.423	2.405	2.388	2.373	2.359	2.346	2.334		
8	238.883	19.371	8.845	6.041	4.818	4.147	3.726	3.438	3.230	3.072	2.948	2.849	2.767	2.699	2.641	2.591	2.548	2.510	2.477	2.447	2.420	2.397	2.375	2.355	2.337	2.321	2.305	2.291	2.278	2.266		
9	240.543	19.385	8.812	5.999	4.772	4.099	3.677	3.388	3.179	3.020	2.896	2.796	2.714	2.646	2.588	2.538	2.494	2.456	2.423	2.393	2.366	2.342	2.320	2.300	2.282	2.265	2.250	2.236	2.223	2.211		
10	241.882	19.396	8.786	5.964	4.735	4.060	3.637	3.347	3.137	2.978	2.854	2.753	2.671	2.602	2.544	2.494	2.450	2.412	2.378	2.348	2.321	2.297	2.275	2.255	2.236	2.220	2.204	2.190	2.177	2.165		
11	242.983	19.405	8.763	5.936	4.704	4.027	3.603	3.313	3.102	2.943	2.818	2.717	2.635	2.565	2.507	2.456	2.413	2.374	2.340	2.310	2.283	2.259	2.236	2.216	2.198	2.181	2.166	2.151	2.138	2.126		
12	243.906	19.413	8.745	5.912	4.678	4.000	3.575	3.284	3.073	2.913	2.788	2.687	2.604	2.534	2.475	2.425	2.381	2.342	2.308	2.278	2.250	2.226	2.204	2.183	2.165	2.148	2.132	2.118	2.104	2.092		
13	244.690	19.419	8.729	5.891	4.655	3.976	3.550	3.259	3.048	2.887	2.761	2.660	2.577	2.507	2.448	2.397	2.353	2.314	2.280	2.250	2.222	2.198	2.175	2.155	2.136	2.119	2.103	2.089	2.075	2.063		
14	245.364	19.424	8.715	5.873	4.636	3.956	3.529	3.237	3.025	2.865	2.739	2.637	2.554	2.484	2.424	2.373	2.329	2.290	2.256	2.225	2.197	2.173	2.150	2.130	2.111	2.094	2.078	2.064	2.050	2.037		
15	245.950	19.429	8.703	5.858	4.619	3.938	3.511	3.218	3.006	2.845	2.719	2.617	2.533	2.463	2.403	2.352	2.308	2.269	2.234	2.203	2.176	2.151	2.128	2.108	2.089	2.072	2.056	2.041	2.027	2.015		
16	246.464	19.433	8.692	5.844	4.604	3.922	3.494	3.202	2.989	2.828	2.701	2.599	2.515	2.445	2.385	2.333	2.289	2.250	2.215	2.184	2.156	2.131	2.109	2.088	2.069	2.052	2.036	2.021	2.007	1.995		
17	246.918	19.437	8.683	5.832	4.590	3.908	3.480	3.187	2.974	2.812	2.685	2.583	2.499	2.428	2.368	2.317	2.272	2.233	2.198	2.167	2.139	2.114	2.091	2.070	2.051	2.034	2.018	2.003	1.989	1.976		
18	247.323	19.440	8.675	5.821	4.579	3.896	3.467	3.173	2.960	2.798	2.671	2.569	2.484	2.413	2.353	2.302	2.257	2.217	2.182	2.151	2.123	2.098	2.075	2.054	2.035	2.018	2.002	1.987	1.973	1.960		
19	247.686	19.443	8.667	5.811	4.568	3.884	3.455	3.161	2.948	2.785	2.658	2.555	2.471	2.400	2.340	2.288	2.243	2.203	2.168	2.137	2.109	2.084	2.061	2.040	2.021	2.003	1.987	1.972	1.958	1.945		
20	248.013	19.446	8.660	5.803	4.558	3.874	3.445	3.150	2.936	2.774	2.646	2.544	2.459	2.388	2.328	2.276	2.230	2.191	2.155	2.124	2.106	2.096	2.071	2.048	2.027	2.007	1.990	1.974	1.959	1.945		
21	248.309	19.448	8.654	5.795	4.549	3.865	3.435	3.140	2.926	2.764	2.636	2.533	2.448	2.377	2.316	2.264	2.219	2.179	2.144	2.112	2.084	2.059	2.036	2.015	1.995	1.978	1.961	1.946	1.932	1.919		
22	248.579	19.450	8.648	5.787	4.541	3.856	3.426	3.131	2.917	2.754	2.626	2.523	2.438	2.367	2.306	2.254	2.208	2.168	2.133	2.102	2.073	2.048	2.025	2.003	1.984	1.966	1.950	1.935	1.921	1.908		
23	248.826	19.452	8.643	5.781	4.534	3.849	3.418	3.123	2.908	2.745	2.617	2.514	2.429	2.357	2.297	2.244	2.199	2.159	2.123	2.092	2.063	2.038	2.014	1.993	1.974	1.956	1.940	1.924	1.910	1.897		
24	249.052	19.454	8.639	5.774	4.527	3.841	3.410	3.115	2.900	2.737	2.609	2.505	2.420	2.349	2.288	2.235	2.190	2.150	2.114	2.082	2.054	2.028	2.005	1.984	1.964	1.946	1.930	1.915	1.901	1.887		
25	249.260	19.456	8.634	5.769	4.521	3.835	3.404	3.108	2.893	2.730	2.601	2.498	2.412	2.341	2.280	2.227	2.181	2.141	2.106	2.074	2.045	2.020	1.996	1.975	1.955	1.938	1.921	1.906	1.891	1.878		
26	249.453	19.457	8.630	5.763	4.515	3.829	3.397	3.102	2.886	2.723	2.594	2.491	2.405	2.333	2.272	2.220	2.174	2.134	2.098	2.066	2.037	2.012	1.988	1.967	1.947	1.929	1.913	1.897	1.883	1.870		
27	249.631	19.459	8.626	5.759	4.510	3.823	3.391	3.095	2.880	2.716	2.588	2.484	2.398	2.326	2.265	2.212	2.167	2.126	2.090	2.059	2.030	2.004	1.981	1.959	1.939	1.921	1.905	1.889	1.875	1.862		
28	249.797	19.460	8.623	5.754	4.505	3.818	3.386	3.090	2.874	2.710	2.582	2.478	2.392	2.320	2.259	2.206	2.160	2.119	2.084	2.052	2.023	1.997	1.973	1.952	1.932	1.914	1.898	1.882	1.868	1.854		
29	249.951	19.461	8.620	5.750	4.500	3.813	3.381	3.084	2.869	2.705	2.576	2.472	2.386	2.314	2.253	2.200	2.154	2.113	2.077	2.045	2.016	1.990	1.967	1.945	1.926	1.907	1.891	1.875	1.861	1.847		
30	250.095	19.462	8.617	5.746	4.496	3.808	3.376	3.079	2.864	2.700	2.570	2.466	2.380	2.308	2.247	2.194	2.148	2.107	2.071	2.039	2.010	1.984	1.961	1.939	1.919	1.901	1.884	1.869	1.854	1.841		
z		0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.30	2.40	2.50	2.60	2.70	2.80	2.90	3.00
0.0000	0.50000	0.46017	0.42074	0.38209	0.34458	0.30854	0.27425	0.24196	0.21186	0.18406	0.15866	0.13567	0.11507	0.09680	0.08076	0.06681	0.05480	0.04457	0.03593	0.02872	0.02275	0.01786	0.01390	0.01072	0.00820	0.00621	0.00466	0.00347	0.00256	0.00187	0.00135	
0.0025	0.49901	0.45918	0.41976	0.38114	0.34366	0.30762	0.27342	0.24118	0.21113	0.18340	0.15805	0.13512	0.11458	0.09637	0.08038	0.06648	0.05452	0.04433	0.03573	0.02853	0.02262	0.01775	0.01382	0.01065	0.00814	0.00617	0.00463	0.00344	0.00254	0.00185	0.00134	
0.0050	0.49801	0.45819	0.41879	0.38016	0.34274	0.30670	0.27250	0.24041	0.21041	0.18																						