Taules

19 de febrer de 2013

1 Estadística Descriptiva

Mitjana aritmètica	$\bar{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$
Variància mostral	$S^2 = \frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X})^2 = \frac{1}{n}\left(\sum_{i=1}^{n} X_i^2\right) - \bar{X}^2$
Variància mostral corregida	$\hat{S}^2 = \frac{n}{n-1}S^2$

Taula 1: Principals fórmules d'Estadística Descriptiva

2 Càlcul de probabilitats

Siguin $A, B \in \Omega$ i P una partició de Ω: $P = \{E_1, \ldots, E_k\}$, aleshores tenim:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$
Probabilitat condicionada $$P(A/B) = \frac{P(A \cap B)}{P(B)}$$
Regla del Producte / Probabilitats composades $$P(A_1 \cap A_2 \cap \ldots A_n) = P(A_1) \cdot P(A_2/A_1) \cdot P(A_3/A_1 \cap A_2) \cdot \ldots \cdot P(A_n/A_1 \cap A_{n-1})$$
Teorema de les probabilitats totals $$P(A) = P(A \cap E_1) + \cdots + P(A \cap E_K) = P(A/E_1)P(E_1) + \cdots + P(A/E_k)P(E_k)$$
Teorema de Bayes $$P(E_i/A) = \frac{P(A/E_i)P(E_i)}{\sum_{j=1}^{k} P(A/E_j)P(E_j)} = \frac{P(A/E_i)P(E_i)}{P(A/E_1)P(E_1) + \cdots + P(A/E_k)P(E_k)}$$

Taula 2: Principals fórmules del Càlcul de Probabilitats

3 Principals Distribucions

Distribució	Paràmetres	Funció de densitat	Esperança	Variància
Uniforme discreta	$x_1,\ldots,x_n$	$f(x)=1/n$	$\sum_{i=1}^{n} X_i/n$	$\sum_{i=1}^{n}(X_i-E(X))^2/n$
Bernoulli	$0\leq p\leq 1$ $q=1-p$	$f(x)=p^x(1-p)^{1-x}$ $x=0,1$	p	$p(1-p)$
Binomial	$0\leq p\leq 1$ $q=1-p$	$f(x)=\left(\begin{array}{c} n \\ x \end{array}\right)p^x(1-p)^{n-x}$ $x=0,1,\ldots,n$	np	$np(1-p)$
Hipergeomètrica	$N=N_1+N_2$ $p=\frac{N_1}{N}$	$f(x)=\frac{\left(\begin{array}{c} N_1 \\ x \end{array}\right)\left(\begin{array}{c} N_2 \\ n-x \end{array}\right)}{\left(\begin{array}{c} N \\ n \end{array}\right)}$ $x=0,1,\ldots,\min\{N_1,n\}$	np	$np(1-p)\frac{N-n}{N-1}$
Binomial negativa	$0\leq p\leq 1$ $q=1-p$ $r>0$	$f(x)=\left(\begin{array}{c} x+r-1 \\ r-1 \end{array}\right)p^r(1-p)^x$ $x=0,1,\ldots$	$\frac{r(1-p)}{p}$	$\frac{r(1-p)}{p^2}$
Poisson	$\lambda>0$	$f(x)=e^{-\lambda}\frac{\lambda^x}{x!}$ $x=0,1,\ldots$	λ	λ
Multinomial	$0\leq p_1,\ldots,p_k\leq 1$ $\sum_{i=1}^{k} p_i=1$ $q_i=1-p_i$	$f(x_1,\ldots,x_k)=$ $\frac{n!}{x_1!x_2!\cdots x_k!}p_1^{x_1}p_2^{x_2}\cdots p_k^{x_k}$	$\left(\begin{array}{c} np_1 \\ np_2 \\ \vdots \\ np_k \end{array}\right)$	$\sigma_{ii}=np_iq_i$ $\sigma_{ij}=-np_ip_j$ $i\neq j$
Uniforme	a,b	$f(x)=\frac{1}{b-a}$ F. distribució $F(x)=\frac{x-a}{b-a}$ $a<x<b$	$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$
Exponencial	$\alpha>0$	$f(x)=\frac{1}{\alpha}e^{-\frac{x}{\alpha}}$ F. distribució $F(x)=1-e^{-x/\alpha}$ $x>0$	α	α^2
Normal	$-\infty<\mu<\infty$ $\sigma>0$	$f(x)=\frac{1}{\sigma\sqrt{2\pi}}e^{-\frac{(x-\mu)^2}{2\sigma^2}}$ $-\infty<x<\infty$	μ	σ^2

Taula 3: Principals Distribucions

4 Inferència Estadística

A totes les taules

$$\frac{\alpha}{2} = P\left(Z > z_{\frac{\alpha}{2}}\right) = P\left(T > t_{\frac{\alpha}{2}}\right) = P\left(\chi^2 > \chi^2_{\frac{\alpha}{2}}\right) = P\left(F > f_{\frac{\alpha}{2}}\right)$$

Z	Distribució N(0,1)
T	Distribució t de Student
χ^2	Distribució Khi-quadrat
F	Distribució F de Fisher

Distribució	Paràmetre	Interval
$N(\mu, \sigma_0)$ (σ_0 coneguda)	μ	$\left(\bar{X}_n - z_{\frac{\alpha}{2}} \frac{\sigma_0}{\sqrt{n}}, \bar{X}_n + z_{\frac{\alpha}{2}} \frac{\sigma_0}{\sqrt{n}}\right)$
$N(\mu, \sigma)$ (σ desconeguda)	μ	$\left(\bar{X}_n - t_{\frac{\alpha}{2}} \frac{\hat{S}}{\sqrt{n}}, \bar{X}_n + t_{\frac{\alpha}{2}} \frac{\hat{S}}{\sqrt{n}}\right)$ graus de llibertat $= n-1$
$N(\mu, \sigma)$	σ^2	$\left(\frac{S^2 n}{\chi^2_{\frac{\alpha}{2}}}, \frac{S^2 n}{\chi^2_{1-\frac{\alpha}{2}}}\right)$ graus de llibertat $= n-1$
Dues poblacions $N(\mu_1, \sigma)$ $N(\mu_2, \sigma)$ (σ comú i desconeguda)	$\mu_1 - \mu_2$	$(\bar{X}_1 - \bar{X}_2) \pm t_{\frac{\alpha}{2}} \cdot \hat{S}_T \cdot \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$ $\hat{S}_T^2 = \frac{(n_1-1)\cdot\hat{S}_1^2 + (n_2-1)\cdot\hat{S}_2^2}{n_1+n_2-2}$ graus de llibertat $= n_1 + n_2 - 2$
Dues poblacions $N(\mu_1, \sigma_1)$ $N(\mu_2, \sigma_2)$	$\frac{\sigma_1^2}{\sigma_2^2}$	$\left(\frac{\hat{S}_1^2/\hat{S}_2^2}{F_{\alpha/2}}, \frac{\hat{S}_1^2/\hat{S}_2^2}{F_{1-\alpha/2}}\right)$ graus de llibertat $= (n_1-1)/(n_2-1)$
Bernoulli (p)	p	$\left(\hat{p} \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}\hat{q}}{n}}\right)$ (asimptòtic aproximat)

Taula 4: Principals Intervals de confiança. En tots els casos es suposa la construcció d'un interval del $(1-\alpha)\cdot 100\%$ de confiança.

Distribució	Paràmetre	Mida de la mostra
$N(\mu, \sigma)$ (σ desconeguda)	μ	$n = \frac{t^2_{\alpha/2}\hat{S}^2}{d^2}$ graus de llibertat $= n-1$
Bernoulli (p)	p	$n = \frac{z^2_{\alpha/2} pq}{d^2}$

Taula 5: Mides de mostra necessàries per assolir una precisió del interval amb radi màxim d

Contrast	H_0	Estadístic de test	Dist. de referència	H_1	Rebuig de H_0
X normal σ coneguda	$\mu = \mu_0$	$Z = \frac{\overline{X}-\mu_0}{\sigma}\sqrt{n}$	$Z \sim N(0,1)$	$\mu \neq \mu_0$ $\mu > \mu_0$ $\mu < \mu_0$	$\lvert Z\rvert \geq z_{\alpha/2}$ $Z \geq z_\alpha$ $Z \leq -z_\alpha$
X normal, σ desconeguda	$\mu = \mu_0$	$T = \frac{\overline{X}-\mu_0}{\hat{S}}\sqrt{n}$	$T \sim$ T Stud. $(n-1)$ gl	$\mu \neq \mu_0$ $\mu > \mu_0$ $\mu < \mu_0$	$\lvert T\rvert \geq t_{\alpha/2}$ $T \geq t_\alpha$ $T \leq -t_\alpha$
X normal σ desconeguda	$\sigma^2 = \sigma_0^2$	$\chi^2 = \frac{(n-1)\hat{S}^2}{\sigma_0^2}$	Khi-quadrat(n-1) gl	$\sigma^2 \neq \sigma_0^2$ $\sigma^2 > \sigma_0^2$ $\sigma^2 < \sigma_0^2$	$\chi^2 \geq \chi^2_{\alpha/2}$ o $\chi^2 \leq \chi^2_{1-\alpha/2}$ $\chi^2 \geq \chi^2_\alpha$ $\chi^2 \leq \chi^2_{1-\alpha}$
X_1,X_2 normals σ_1, σ_2 desconegudes, $\sigma_1 = \sigma_2$	$d = d_0$ $(d = \mu_1 - \mu_2)$	$T = \frac{(\overline{X}_1-\overline{X}_2)-d_0}{\hat{S}_T \cdot \sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$ $\hat{S}_T^2 = \frac{(n_1-1)\cdot\hat{S}_1^2+(n_2-1)\cdot\hat{S}_2^2}{n_1+n_2-2}$	$T \sim$ T Stud. (n_1+n_2-2) gl	$d \neq d_0$ $d > d_0$ $d < d_0$	$\lvert T\rvert \geq t_{\alpha/2}$ $T \geq t_\alpha$ $T \leq -t_\alpha$
X_1,X_2 normals σ_1, σ_2 desconegudes, $\sigma_1 \neq \sigma_2$	$d = d_0$ $(d = \mu_1 - \mu_2)$	$T = \frac{(\overline{X}_1-\overline{X}_2)-d_0}{\sqrt{(\hat{S}_1^2/n_1)+(\hat{S}_2^2/n_2)}}$	$T \sim$ T Stud. gl $= \frac{(\hat{S}_1^2/n_1+\hat{S}_2^2/n_2)^2}{\frac{(\hat{S}_1^2/n_1)^2}{n_1+1}+\frac{(\hat{S}_2^2/n_2)^2}{n_2+1}} - 2$	$d \neq d_0$ $d > d_0$ $d < d_0$	$\lvert T\rvert \geq T'_{\alpha/2}$ $T \geq T'_\alpha$ $T \leq -T'_\alpha$
X_1,X_2 normals	$\sigma_1^2 = \sigma_2^2$	$F = \frac{\hat{S}_1^2}{\hat{S}_2^2}$	$F \sim$ F Fisher (n_1-1, n_2-1) gl	$\sigma_1^2 \neq \sigma_2^2$ $\sigma_1^2 > \sigma_2^2$ $\sigma_1^2 < \sigma_2^2$	$F \geq f_{\alpha/2}$ o $F \leq f_{1-\alpha/2}$ $F \geq f_\alpha$ $F \leq f_{1-\alpha}$

Taula 6: Principals Contrastos d'hipòtesis per a dades contínues

Distribució	Contrast	Mida de la mostra
$N(\mu,\sigma)$ (σ desconeguda)	$H_0 : \mu = \mu_0$ $H_0 : \mu \neq \mu_0$	$n = \left(\frac{t_{\alpha/2}+t_{1-\beta}}{\Delta}\right)^2 \hat{S}^2$ graus de llibertat $= n-1$

Taula 7: Mida de la mostra necessària per assolir un nivell de significació α i una potència β amb una diferència mínima significativa igual a Δ i basada en una mostra pilot de mida n.

Contrast	H_0	Estadístic de test	Dist. de referència	H_1	Rebuig de H_0
X Bernoulli $n \geq 30, np_0 \geq 5$	$p = p_0$	$Z = \frac{\hat{p}-p_0}{\sqrt{\frac{p_0 q_0}{n}}}$	$Z \sim N(0,1)$	$p \neq p_0$ $p > p_0$ $p < p_0$	$\lvert Z\rvert \geq z_{\alpha/2}$ $Z \geq z_\alpha$ $Z \leq -z_\alpha$
X_1 Bernoulli X_2 Bernoulli $n_1, n_2 \geq 30$ $n_1\hat{p}_1, n_2\hat{p}_2 \geq 5$	$p_1 = p_2$	$Z = \frac{\hat{p}_1-\hat{p}_2}{\sqrt{\frac{\hat{p}\hat{q}}{n_1}+\frac{\hat{p}\hat{q}}{n_2}}}$ $\hat{p} = \frac{n_1\hat{p}_1+n_2\hat{p}_2}{n_1+n_2}$	$Y \sim N(0,1)$	$p_1 \neq p_2$ $p_1 > p_2$ $p_1 < p_2$	$\lvert Z\rvert \geq z_{\alpha/2}$ $Z \geq z_\alpha$ $Z \leq -z_\alpha$
Condicions	Contrast	Estadístic de test	Dist. de referència	Rebuig de H_0	
$X \sim MN(n,(p_1,\ldots,p_k))$ en més del 80 % de les classes $E_i \geq 5$	$H_0: \mathbf{p} = (p_1^0,\ldots,p_k^0)$ $H_1: \mathbf{p} \neq (p_1^0,\ldots,p_k^0)$	$\chi^2 = \sum_{i=1}^{k} \frac{(O_i-E_i)^2}{E_i}$ O_i : freqüència observada E_i : freqüència esperada $E_i = n \cdot p_i$	$\chi^2 \sim Khi-Quadrat$ $k-1-m$ gl. $m =$ nombre de paràmetres estimats	$\chi^2 \geq \chi^2_\alpha$	
$\begin{array}{c\|cccc} & A_1 & \ldots & A_s & \\ \hline B_1 & n_{11} & \ldots & n_{1s} & n_{1+} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ B_r & n_{s1} & \ldots & n_{rs} & n_{r+} \\ \hline & n_{+1} & \ldots & n_{+s} & n \end{array}$ en més del 80 % de les caselles $E_{ij} \geq 5$	Test de homogeneïtat Test d'independència	$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{s} \frac{(n_{ij}-E_{ij})^2}{E_{ij}}$ E_{ij} : freqüència esperada $E_{ij} = \frac{n_{i+}n_{+j}}{n}$	$\chi^2 \sim Khi-Quadrat$ $(r-1)\cdot(s-1)$ gl.	$\chi^2 \geq \chi^2_\alpha$	
Correcció de Yates	Test de homogeneïtat Test d'independència	$\chi^2 = n\frac{\left(\lvert n_{11}n_{22}-n_{12}n_{21}\rvert-\frac{n}{2}\right)^2}{n_{1+}n_{2+}n_{+1}n_{+2}}$	$\chi^2 \sim Khi-Quadrat$ 1 gl.	$\chi^2 \geq \chi^2_\alpha$	

Taula 8: Principals Contrastos d'hipòtesis per a proporcions i test khi-quadrat

5 Regressió

Recta de regressió de Y/X
$\hat{Y} = a + bX$ on $b = \frac{\sum_i (X_i - \overline{X})(Y_i - \overline{Y})}{\sum_i (X_i - \overline{X})^2}$ $a = \overline{Y} - b\overline{X}$

Paràmetre	Interval
β (Pendent de la recta)	$b \pm t_{\alpha/2} \sqrt{\frac{S_E^2}{\sum_{i=1}^n (X_i - \overline{X})^2}}$
Predicció del valor mig de Y donat X_0	$a + bX_0 \pm t_{\alpha/2} \sqrt{\left(\frac{1}{n} + \frac{(X_0 - \overline{X})^2}{\sum_{i=1}^n (X_i - \overline{X})^2}\right) S_E^2}$
Predicció d'un valor individual de Y donat X_0	$a + bX_0 \pm t_{\alpha/2} \sqrt{\left(\frac{1}{n} + 1 + \frac{(X_0 - \overline{X})^2}{\sum_{i=1}^n (X_i - \overline{X})^2}\right) S_E^2}$

on $S_E^2 = \frac{1}{n-2} \sum_{i=1}^n (Y_i - \hat{Y}_i)^2 = \frac{1}{n-2} \left(\sum_{i=1}^n (Y_i - \overline{Y})^2 - b \sum_{i=1}^n (X_i - \overline{X})(Y_i - \overline{Y}) \right)$.

En tots els casos es suposa la construcció d'un interval del $(1-\alpha) \cdot 100\%$ de confiança.

Covariància entre X i Y	$S_{xy} = \frac{1}{n} \sum_{i=1}^n (X_i - \overline{X})(Y_i - \overline{Y})$
Coeficient de correlació	$r = \frac{S_{xy}}{S_x S_y}$
Coeficient de determinació	$r^2 = 1 - \frac{S_E^2}{S_y^2}$

Contrast	Estadístic de test	Dist. de referència	Rebuig de H_0
$H_0 : \rho = 0$ $H_1 : \rho \neq 0$	$T = \sqrt{n-2} \frac{r}{\sqrt{1-r^2}}$	$T \sim$ T Stud. $(n-2)$ gl	$\lvert T \rvert \geq t_{\alpha/2}$

Taula 9: Anàlisi Estadístic en Regressió

6 Distribució Normal N(0,1): Funció de distribució

	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986

Taula 10: Funció de distribució de la distribució N(0,1)

x	3	3.1	3.2	3.3	3.4	3.5	3.6	3.8	4
F(x)	0.99865	0.99903	0.99931	0.99952	0.99966	0.99977	0.99984	0.99993	0.99997

Taula 11: Taula per grans valors de x

x	2.576	2.326	2.17	2.054	1.96	1.645	1.44	1.282	1.15
F(x)	0.995	0.990	0.985	0.980	0.975	0.950	0.925	0.900	0.875

Taula 12: Taula per alguns valors especials

7 Distribució T de Student

gl \ F(x)	0.6	0.7	0.75	0.8	0.85	0.9	0.925	0.95	0.975	0.99	0.995	0.9995
3	0.277	0.584	0.765	0.978	1.250	1.638	1.924	2.353	3.182	4.541	5.841	12.924
4	0.271	0.569	0.741	0.941	1.190	1.533	1.778	2.132	2.776	3.747	4.604	8.610
5	0.267	0.559	0.727	0.920	1.156	1.476	1.699	2.015	2.571	3.365	4.032	6.869
6	0.265	0.553	0.718	0.906	1.134	1.440	1.650	1.943	2.447	3.143	3.707	5.959
7	0.263	0.549	0.711	0.896	1.119	1.415	1.617	1.895	2.365	2.998	3.499	5.408
8	0.262	0.546	0.706	0.889	1.108	1.397	1.592	1.860	2.306	2.896	3.355	5.041
9	0.261	0.543	0.703	0.883	1.100	1.383	1.574	1.833	2.262	2.821	3.250	4.781
10	0.260	0.542	0.700	0.879	1.093	1.372	1.559	1.812	2.228	2.764	3.169	4.587
11	0.260	0.540	0.697	0.876	1.088	1.363	1.548	1.796	2.201	2.718	3.106	4.437
12	0.259	0.539	0.695	0.873	1.083	1.356	1.538	1.782	2.179	2.681	3.055	4.318
13	0.259	0.538	0.694	0.870	1.079	1.350	1.530	1.771	2.160	2.650	3.012	4.221
14	0.258	0.537	0.692	0.868	1.076	1.345	1.523	1.761	2.145	2.624	2.977	4.140
15	0.258	0.536	0.691	0.866	1.074	1.341	1.517	1.753	2.131	2.602	2.947	4.073
16	0.258	0.535	0.690	0.865	1.071	1.337	1.512	1.746	2.120	2.583	2.921	4.015
17	0.257	0.534	0.689	0.863	1.069	1.333	1.508	1.740	2.110	2.567	2.898	3.965
18	0.257	0.534	0.688	0.862	1.067	1.330	1.504	1.734	2.101	2.552	2.878	3.922
19	0.257	0.533	0.688	0.861	1.066	1.328	1.500	1.729	2.093	2.539	2.861	3.883
20	0.257	0.533	0.687	0.860	1.064	1.325	1.497	1.725	2.086	2.528	2.845	3.850
21	0.257	0.532	0.686	0.859	1.063	1.323	1.494	1.721	2.080	2.518	2.831	3.819
22	0.256	0.532	0.686	0.858	1.061	1.321	1.492	1.717	2.074	2.508	2.819	3.792
23	0.256	0.532	0.685	0.858	1.060	1.319	1.489	1.714	2.069	2.500	2.807	3.768
24	0.256	0.531	0.685	0.857	1.059	1.318	1.487	1.711	2.064	2.492	2.797	3.745
25	0.256	0.531	0.684	0.856	1.058	1.316	1.485	1.708	2.060	2.485	2.787	3.725
26	0.256	0.531	0.684	0.856	1.058	1.315	1.483	1.706	2.056	2.479	2.779	3.707
27	0.256	0.531	0.684	0.855	1.057	1.314	1.482	1.703	2.052	2.473	2.771	3.690
28	0.256	0.530	0.683	0.855	1.056	1.313	1.480	1.701	2.048	2.467	2.763	3.674
29	0.256	0.530	0.683	0.854	1.055	1.311	1.479	1.699	2.045	2.462	2.756	3.659
30	0.256	0.530	0.683	0.854	1.055	1.310	1.477	1.697	2.042	2.457	2.750	3.646
40	0.255	0.529	0.681	0.851	1.050	1.303	1.468	1.684	2.021	2.423	2.704	3.551
50	0.255	0.528	0.679	0.849	1.047	1.299	1.462	1.676	2.009	2.403	2.678	3.496
60	0.254	0.527	0.679	0.848	1.045	1.296	1.458	1.671	2.000	2.390	2.660	3.460
100	0.254	0.526	0.677	0.845	1.042	1.290	1.451	1.660	1.984	2.364	2.626	3.390
10000	0.253	0.524	0.675	0.842	1.036	1.282	1.440	1.645	1.960	2.327	2.576	3.291

Taula 13: Valors crítics per la Distribució T

	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0	0.5000	0.5039	0.5078	0.5116	0.5155	0.5194	0.5233	0.5271	0.5310	0.5349
0.1	0.5387	0.5426	0.5464	0.5503	0.5541	0.5580	0.5618	0.5656	0.5694	0.5732
0.2	0.5770	0.5808	0.5846	0.5884	0.5921	0.5959	0.5996	0.6034	0.6071	0.6108
0.3	0.6145	0.6182	0.6219	0.6255	0.6292	0.6328	0.6364	0.6400	0.6436	0.6472
0.4	0.6508	0.6543	0.6578	0.6613	0.6648	0.6683	0.6718	0.6752	0.6787	0.6821
0.5	0.6855	0.6888	0.6922	0.6955	0.6988	0.7021	0.7054	0.7087	0.7119	0.7151
0.6	0.7183	0.7215	0.7247	0.7278	0.7309	0.7340	0.7371	0.7402	0.7432	0.7462
0.7	0.7492	0.7522	0.7551	0.7580	0.7609	0.7638	0.7667	0.7695	0.7723	0.7751
0.8	0.7778	0.7806	0.7833	0.7860	0.7887	0.7913	0.7939	0.7965	0.7991	0.8017
0.9	0.8042	0.8067	0.8092	0.8117	0.8141	0.8165	0.8189	0.8213	0.8237	0.8260
1	0.8283	0.8306	0.8328	0.8351	0.8373	0.8395	0.8416	0.8438	0.8459	0.8480
1.1	0.8501	0.8521	0.8541	0.8562	0.8581	0.8601	0.8621	0.8640	0.8659	0.8678
1.2	0.8696	0.8715	0.8733	0.8751	0.8768	0.8786	0.8803	0.8820	0.8837	0.8854
1.3	0.8870	0.8887	0.8903	0.8919	0.8935	0.8950	0.8965	0.8981	0.8996	0.9010
1.4	0.9025	0.9039	0.9053	0.9067	0.9081	0.9095	0.9109	0.9122	0.9135	0.9148
1.5	0.9161	0.9173	0.9186	0.9198	0.9210	0.9222	0.9234	0.9246	0.9257	0.9269
1.6	0.9280	0.9291	0.9302	0.9312	0.9323	0.9333	0.9344	0.9354	0.9364	0.9374
1.7	0.9383	0.9393	0.9402	0.9412	0.9421	0.9430	0.9439	0.9447	0.9456	0.9465
1.8	0.9473	0.9481	0.9489	0.9498	0.9505	0.9513	0.9521	0.9529	0.9536	0.9543
1.9	0.9551	0.9558	0.9565	0.9572	0.9578	0.9585	0.9592	0.9598	0.9605	0.9611
2	0.9617	0.9623	0.9629	0.9635	0.9641	0.9647	0.9653	0.9658	0.9664	0.9669
2.1	0.9674	0.9680	0.9685	0.9690	0.9695	0.9700	0.9705	0.9709	0.9714	0.9719
2.2	0.9723	0.9728	0.9732	0.9737	0.9741	0.9745	0.9749	0.9753	0.9757	0.9761
2.3	0.9765	0.9769	0.9773	0.9776	0.9780	0.9783	0.9787	0.9790	0.9794	0.9797
2.4	0.9801	0.9804	0.9807	0.9810	0.9813	0.9816	0.9819	0.9822	0.9825	0.9828
2.5	0.9831	0.9833	0.9836	0.9839	0.9841	0.9844	0.9847	0.9849	0.9852	0.9854
2.6	0.9856	0.9859	0.9861	0.9863	0.9865	0.9868	0.9870	0.9872	0.9874	0.9876
2.7	0.9878	0.9880	0.9882	0.9884	0.9886	0.9888	0.9889	0.9891	0.9893	0.9895
2.8	0.9896	0.9898	0.9900	0.9901	0.9903	0.9905	0.9906	0.9908	0.9909	0.9911
2.9	0.9912	0.9913	0.9915	0.9916	0.9918	0.9919	0.9920	0.9921	0.9923	0.9924
3	0.9925	0.9926	0.9928	0.9929	0.9930	0.9931	0.9932	0.9933	0.9934	0.9935
3.1	0.9936	0.9937	0.9938	0.9939	0.9940	0.9941	0.9942	0.9943	0.9944	0.9945
3.2	0.9946	0.9947	0.9948	0.9948	0.9949	0.9950	0.9951	0.9952	0.9952	0.9953
3.3	0.9954	0.9955	0.9955	0.9956	0.9957	0.9957	0.9958	0.9959	0.9959	0.9960
3.4	0.9961	0.9961	0.9962	0.9962	0.9963	0.9964	0.9964	0.9965	0.9965	0.9966
3.5	0.9966	0.9967	0.9967	0.9968	0.9968	0.9969	0.9969	0.9970	0.9970	0.9971
3.6	0.9971	0.9972	0.9972	0.9973	0.9973	0.9973	0.9974	0.9974	0.9975	0.9975
3.7	0.9975	0.9976	0.9976	0.9977	0.9977	0.9977	0.9978	0.9978	0.9978	0.9979
3.8	0.9979	0.9979	0.9980	0.9980	0.9980	0.9980	0.9981	0.9981	0.9981	0.9982
3.9	0.9982	0.9982	0.9982	0.9983	0.9983	0.9983	0.9983	0.9984	0.9984	0.9984

Taula 14: Funció de distribució de la distribució T de Student amb 9 graus de llibertat

8 Distribució Khi-quadrat

gl \ F(x)	0.01	0.025	0.05	0.1	0.25	0.5	0.75	0.9	0.925	0.95	0.975	0.99
1	0.000	0.001	0.004	0.016	0.102	0.455	1.323	2.706	3.170	3.841	5.024	6.635
2	0.020	0.051	0.103	0.211	0.575	1.386	2.773	4.605	5.181	5.991	7.378	9.210
3	0.115	0.216	0.352	0.584	1.213	2.366	4.108	6.251	6.905	7.815	9.348	11.345
4	0.297	0.484	0.711	1.064	1.923	3.357	5.385	7.779	8.496	9.488	11.143	13.277
5	0.554	0.831	1.145	1.610	2.675	4.351	6.626	9.236	10.008	11.070	12.833	15.086
6	0.872	1.237	1.635	2.204	3.455	5.348	7.841	10.645	11.466	12.592	14.449	16.812
7	1.239	1.690	2.167	2.833	4.255	6.346	9.037	12.017	12.883	14.067	16.013	18.475
8	1.646	2.180	2.733	3.490	5.071	7.344	10.219	13.362	14.270	15.507	17.535	20.090
9	2.088	2.700	3.325	4.168	5.899	8.343	11.389	14.684	15.631	16.919	19.023	21.666
10	2.558	3.247	3.940	4.865	6.737	9.342	12.549	15.987	16.971	18.307	20.483	23.209
11	3.053	3.816	4.575	5.578	7.584	10.341	13.701	17.275	18.294	19.675	21.920	24.725
12	3.571	4.404	5.226	6.304	8.438	11.340	14.845	18.549	19.602	21.026	23.337	26.217
13	4.107	5.009	5.892	7.042	9.299	12.340	15.984	19.812	20.897	22.362	24.736	27.688
14	4.660	5.629	6.571	7.790	10.165	13.339	17.117	21.064	22.180	23.685	26.119	29.141
15	5.229	6.262	7.261	8.547	11.037	14.339	18.245	22.307	23.452	24.996	27.488	30.578
16	5.812	6.908	7.962	9.312	11.912	15.338	19.369	23.542	24.716	26.296	28.845	32.000
17	6.408	7.564	8.672	10.085	12.792	16.338	20.489	24.769	25.970	27.587	30.191	33.409
18	7.015	8.231	9.390	10.865	13.675	17.338	21.605	25.989	27.218	28.869	31.526	34.805
19	7.633	8.907	10.117	11.651	14.562	18.338	22.718	27.204	28.458	30.144	32.852	36.191
20	8.260	9.591	10.851	12.443	15.452	19.337	23.828	28.412	29.692	31.410	34.170	37.566
21	8.897	10.283	11.591	13.240	16.344	20.337	24.935	29.615	30.920	32.671	35.479	38.932
22	9.542	10.982	12.338	14.041	17.240	21.337	26.039	30.813	32.142	33.924	36.781	40.289
23	10.196	11.689	13.091	14.848	18.137	22.337	27.141	32.007	33.360	35.172	38.076	41.638
24	10.856	12.401	13.848	15.659	19.037	23.337	28.241	33.196	34.572	36.415	39.364	42.980
25	11.524	13.120	14.611	16.473	19.939	24.337	29.339	34.382	35.780	37.652	40.646	44.314
26	12.198	13.844	15.379	17.292	20.843	25.336	30.435	35.563	36.984	38.885	41.923	45.642
27	12.879	14.573	16.151	18.114	21.749	26.336	31.528	36.741	38.184	40.113	43.195	46.963
28	13.565	15.308	16.928	18.939	22.657	27.336	32.620	37.916	39.380	41.337	44.461	48.278
29	14.256	16.047	17.708	19.768	23.567	28.336	33.711	39.087	40.573	42.557	45.722	49.588
30	14.953	16.791	18.493	20.599	24.478	29.336	34.800	40.256	41.762	43.773	46.979	50.892
31	15.655	17.539	19.281	21.434	25.390	30.336	35.887	41.422	42.948	44.985	48.232	52.191
32	16.362	18.291	20.072	22.271	26.304	31.336	36.973	42.585	44.131	46.194	49.480	53.486
33	17.074	19.047	20.867	23.110	27.219	32.336	38.058	43.745	45.311	47.400	50.725	54.776
34	17.789	19.806	21.664	23.952	28.136	33.336	39.141	44.903	46.488	48.602	51.966	56.061
35	18.509	20.569	22.465	24.797	29.054	34.336	40.223	46.059	47.663	49.802	53.203	57.342
36	19.233	21.336	23.269	25.643	29.973	35.336	41.304	47.212	48.835	50.998	54.437	58.619
37	19.960	22.106	24.075	26.492	30.893	36.336	42.383	48.363	50.005	52.192	55.668	59.893
38	20.691	22.878	24.884	27.343	31.815	37.335	43.462	49.513	51.173	53.384	56.896	61.162
39	21.426	23.654	25.695	28.196	32.737	38.335	44.539	50.660	52.338	54.572	58.120	62.428
40	22.164	24.433	26.509	29.051	33.660	39.335	45.616	51.805	53.501	55.758	59.342	63.691

Taula 15: Valors crítics per la Distribució Khi-quadrat

	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
1	0.6827	0.6851	0.6875	0.6898	0.6922	0.6945	0.6968	0.6991	0.7013	0.7035
1.1	0.7057	0.7079	0.7101	0.7122	0.7143	0.7165	0.7185	0.7206	0.7226	0.7247
1.2	0.7267	0.7287	0.7306	0.7326	0.7345	0.7364	0.7383	0.7402	0.7421	0.7440
1.3	0.7458	0.7476	0.7494	0.7512	0.7530	0.7547	0.7565	0.7582	0.7599	0.7616
1.4	0.7633	0.7649	0.7666	0.7682	0.7699	0.7715	0.7731	0.7747	0.7762	0.7778
1.5	0.7793	0.7809	0.7824	0.7839	0.7854	0.7869	0.7883	0.7898	0.7912	0.7927
1.6	0.7941	0.7955	0.7969	0.7983	0.7997	0.8010	0.8024	0.8037	0.8051	0.8064
1.7	0.8077	0.8090	0.8103	0.8116	0.8129	0.8141	0.8154	0.8166	0.8179	0.8191
1.8	0.8203	0.8215	0.8227	0.8239	0.8250	0.8262	0.8274	0.8285	0.8297	0.8308
1.9	0.8319	0.8330	0.8341	0.8352	0.8363	0.8374	0.8385	0.8396	0.8406	0.8417
2	0.8427	0.8437	0.8448	0.8458	0.8468	0.8478	0.8488	0.8498	0.8508	0.8517
2.1	0.8527	0.8537	0.8546	0.8556	0.8565	0.8574	0.8584	0.8593	0.8602	0.8611
2.2	0.8620	0.8629	0.8638	0.8646	0.8655	0.8664	0.8672	0.8681	0.8689	0.8698
2.3	0.8706	0.8715	0.8723	0.8731	0.8739	0.8747	0.8755	0.8763	0.8771	0.8779
2.4	0.8787	0.8794	0.8802	0.8810	0.8817	0.8825	0.8832	0.8840	0.8847	0.8854
2.5	0.8862	0.8869	0.8876	0.8883	0.8890	0.8897	0.8904	0.8911	0.8918	0.8925
2.6	0.8931	0.8938	0.8945	0.8951	0.8958	0.8965	0.8971	0.8977	0.8984	0.8990
2.7	0.8997	0.9003	0.9009	0.9015	0.9021	0.9027	0.9034	0.9040	0.9046	0.9051
2.8	0.9057	0.9063	0.9069	0.9075	0.9081	0.9086	0.9092	0.9098	0.9103	0.9109
2.9	0.9114	0.9120	0.9125	0.9131	0.9136	0.9141	0.9147	0.9152	0.9157	0.9162
3	0.9167	0.9172	0.9178	0.9183	0.9188	0.9193	0.9198	0.9203	0.9207	0.9212
3.1	0.9217	0.9222	0.9227	0.9231	0.9236	0.9241	0.9245	0.9250	0.9255	0.9259
3.2	0.9264	0.9268	0.9273	0.9277	0.9281	0.9286	0.9290	0.9294	0.9299	0.9303
3.3	0.9307	0.9311	0.9316	0.9320	0.9324	0.9328	0.9332	0.9336	0.9340	0.9344
3.4	0.9348	0.9352	0.9356	0.9360	0.9364	0.9367	0.9371	0.9375	0.9379	0.9383
3.5	0.9386	0.9390	0.9394	0.9397	0.9401	0.9405	0.9408	0.9412	0.9415	0.9419
3.6	0.9422	0.9426	0.9429	0.9433	0.9436	0.9439	0.9443	0.9446	0.9449	0.9453
3.7	0.9456	0.9459	0.9462	0.9466	0.9469	0.9472	0.9475	0.9478	0.9481	0.9484
3.8	0.9487	0.9491	0.9494	0.9497	0.9500	0.9503	0.9505	0.9508	0.9511	0.9514
3.9	0.9517	0.9520	0.9523	0.9526	0.9528	0.9531	0.9534	0.9537	0.9540	0.9542
4	0.9545	0.9548	0.9550	0.9553	0.9556	0.9558	0.9561	0.9563	0.9566	0.9569
4.1	0.9571	0.9574	0.9576	0.9579	0.9581	0.9584	0.9586	0.9589	0.9591	0.9593
4.2	0.9596	0.9598	0.9600	0.9603	0.9605	0.9607	0.9610	0.9612	0.9614	0.9617
4.3	0.9619	0.9621	0.9623	0.9626	0.9628	0.9630	0.9632	0.9634	0.9636	0.9638
4.4	0.9641	0.9643	0.9645	0.9647	0.9649	0.9651	0.9653	0.9655	0.9657	0.9659
4.5	0.9661	0.9663	0.9665	0.9667	0.9669	0.9671	0.9673	0.9675	0.9677	0.9678
4.6	0.9680	0.9682	0.9684	0.9686	0.9688	0.9689	0.9691	0.9693	0.9695	0.9697
4.7	0.9698	0.9700	0.9702	0.9704	0.9705	0.9707	0.9709	0.9710	0.9712	0.9714
4.8	0.9715	0.9717	0.9719	0.9720	0.9722	0.9724	0.9725	0.9727	0.9728	0.9730
4.9	0.9731	0.9733	0.9735	0.9736	0.9738	0.9739	0.9741	0.9742	0.9744	0.9745
5	0.9747	0.9748	0.9749	0.9751	0.9752	0.9754	0.9755	0.9757	0.9758	0.9759
5.1	0.9761	0.9762	0.9763	0.9765	0.9766	0.9768	0.9769	0.9770	0.9772	0.9773
5.2	0.9774	0.9775	0.9777	0.9778	0.9779	0.9781	0.9782	0.9783	0.9784	0.9786
5.3	0.9787	0.9788	0.9789	0.9790	0.9792	0.9793	0.9794	0.9795	0.9796	0.9797
5.4	0.9799	0.9800	0.9801	0.9802	0.9803	0.9804	0.9805	0.9807	0.9808	0.9809
5.5	0.9810	0.9811	0.9812	0.9813	0.9814	0.9815	0.9816	0.9817	0.9818	0.9819
5.6	0.9820	0.9821	0.9822	0.9823	0.9824	0.9825	0.9826	0.9827	0.9828	0.9829
5.7	0.9830	0.9831	0.9832	0.9833	0.9834	0.9835	0.9836	0.9837	0.9838	0.9839
5.8	0.9840	0.9841	0.9842	0.9842	0.9843	0.9844	0.9845	0.9846	0.9847	0.9848
5.9	0.9849	0.9849	0.9850	0.9851	0.9852	0.9853	0.9854	0.9854	0.9855	0.9856
6	0.9857	0.9858	0.9859	0.9859	0.9860	0.9861	0.9862	0.9863	0.9863	0.9864
6.1	0.9865	0.9866	0.9866	0.9867	0.9868	0.9869	0.9869	0.9870	0.9871	0.9872
6.2	0.9872	0.9873	0.9874	0.9874	0.9875	0.9876	0.9877	0.9877	0.9878	0.9879
6.3	0.9879	0.9880	0.9881	0.9881	0.9882	0.9883	0.9883	0.9884	0.9885	0.9885
6.4	0.9886	0.9887	0.9887	0.9888	0.9888	0.9889	0.9890	0.9890	0.9891	0.9892
6.5	0.9892	0.9893	0.9893	0.9894	0.9895	0.9895	0.9896	0.9896	0.9897	0.9897
6.6	0.9898	0.9899	0.9899	0.9900	0.9900	0.9901	0.9901	0.9902	0.9902	0.9903
6.7	0.9904	0.9904	0.9905	0.9905	0.9906	0.9906	0.9907	0.9907	0.9908	0.9908
6.8	0.9909	0.9909	0.9910	0.9910	0.9911	0.9911	0.9912	0.9912	0.9913	0.9913
6.9	0.9914	0.9914	0.9915	0.9915	0.9916	0.9916	0.9917	0.9917	0.9918	0.9918

Taula 16: Funció de distribució de la distribució Khi-quadrat amb 1 grau de llibertat