(Y_{i1}, X_{i1}) 同关合分布:

$$SS_R = \hat{\beta}_1^2 l_{xx} = \sum (\hat{y}_i - \bar{y})^2 \qquad l_{xx} = \sum x_i^2 - n\bar{x}^2$$

$$l_{yy} = \sum y_i^2 - n\bar{y}^2$$

$$SS_T = SS_R + SS_E$$

$$SS_E = \sum (y_i - \hat{y}_i)^2 \qquad \hat{\sigma}^2 = \frac{SS_E}{n-2} \qquad \frac{(n-2)\hat{\sigma}^2}{\sigma^2} \sim \chi^2(n-2)$$

$$F = \frac{SS_R}{\frac{SS_E}{n-2}} = \frac{SS_R}{\hat{\sigma}^2} \sim F(1, n-2)$$

$\left\{\begin{array}{l} SS_T = l_{yy} \text{ 好算} \\ SS_R = \hat{\beta}_1^2 l_{xx} \text{ 好算} \end{array}\right\} \; SS_E = SS_T - SS_R \downarrow \; \hat{\sigma} = \sqrt{\frac{SSE}{n-2}}$

$$P(F > F_\alpha(1, n-2)) = \alpha$$

$$r^2 = \frac{SS_R}{SS_T} = \frac{\hat{\beta}_1^2 l_{xx}}{l_{yy}} = R^2 = \frac{1}{1 + \frac{n-2}{F}}.$$

$$= \frac{l_{xy}}{\sqrt{l_{xx} l_{yy}}}$$

$$T = \frac{y_0 - \hat{y}_0}{\sqrt{1 + h_{00}}\,\hat{\sigma}} \sim t(n-2) \qquad \frac{\hat{y}_0 - y_0}{\sqrt{1 + h_{00}}\,\hat{\sigma}} \sim t(n-2) \qquad h_{00} = \frac{1}{n} + \frac{(x_0 - \bar{x})^2}{l_{xx}}$$

$$h_{00} = \frac{1}{n} + \frac{(x_0 - \bar{x})^2}{l_{xx}}$$

$$T = \frac{(\hat{\beta}_1 - \beta_1)\sqrt{l_{xx}}}{\hat{\sigma}} \sim t(n-2) \qquad \frac{\hat{\beta}_0 - \beta_0}{\hat{\sigma}\sqrt{\frac{1}{n} + \frac{\bar{x}^2}{l_{xx}}}} \sim t(n-2)$$

$$T = \frac{\hat{\beta}_0 - \beta_0}{\hat{\sigma}\sqrt{\frac{1}{n} + \frac{\bar{x}^2}{l_{xx}}}} \sim \qquad \frac{(\hat{\beta}_1 - \beta_1)\sqrt{l_{xx}}}{\hat{\sigma}\cancel{\sqrt{\quad}}} \sim t(n-2)$$

C6:

$$SS_T = \sum\sum (x_{ij})^2 - C \qquad df_t = k - 1 \qquad SS_T = SS_t + SS_e$$

$$df_e = nk - k$$

$$SS_t = \frac{1}{n}\sum_{i=1}^{k} x_{i\cdot}^2 - C \qquad df_T = df_t + df_e$$

$$SS_e = SS_T - SS_t$$

~~$SS_e =$~~

$$C = \frac{(x_{\cdot\cdot})^2}{nk}$$

(1)

$(X_{(i)}, X_{(j)})$ 联合分布:

$$f_{ij}(y,z) = \frac{n!}{(i-1)!(j-i-1)!(n-j)!}[F(y)]^{i-1}[F(z)-F(y)]^{j-i-1}[1-F(z)]^{n-j} f(y)f(z)$$

$$f_{ij}(y,z) = \frac{n!}{(i-1)!(j-i-1)!(n-j)!}[F(y)]^{i-1}[F(z)-F(y)]^{j-i-1}[1-F(z)]^{n-j} f(y)f(z)$$

$$f_k(x) = \frac{n!}{(k-1)!(n-k)!} F(x)^{k-1}(1-F(x))^{n-k} f(x) \quad x \in \mathbb{R}$$

$$f_k(x) = \frac{n!}{(k-1)!(n-k)!} F(x)^{k-1}(1-F(x))^{n-k} f(x)$$

$$f_1(x) = n(1-F(x))^{n-1} f(x)$$

$$f_n(x) = n F(x)^{n-1} f(x)$$

$$f_{ij}(y,z) = \frac{n!}{(i-1)!(j-i-1)!(n-j)!} F(y)^{i-1}[F(z)-F(y)]^{j-i-1}(1-F(z))^{n-j} f(y)f(z)$$

$$\frac{\beta_0-\hat\beta_0}{\hat\sigma\sqrt{\frac{1}{n}+\frac{\bar x^2}{l_{xx}}}} \sim t(n-2) \qquad \frac{\beta_0-\hat\beta_0}{\hat\sigma\sqrt{\frac{1}{n}+\frac{\bar x^2}{l_{xx}}}} \sim t(n-2)$$

$$\hat\beta_1 \sim N\left(\beta_1, \sigma^2\frac{1}{l_{xx}}\right)$$

$$\hat\beta_0 \sim N\left(\beta_0, \sigma^2\left(\frac{1}{n}+\frac{\bar x^2}{l_{xx}}\right)\right)$$

$$\frac{\beta_1-\hat\beta_1}{\hat\sigma\sqrt{\frac{1}{l_{xx}}}} \sim t(n-2) \qquad \frac{\beta_1-\hat\beta_1}{\hat\sigma\sqrt{\frac{1}{l_{xx}}}} \sim t(n-2)$$

$$\cancel{\hat y_0 \sim N(\hat y_0,}$$

$$y_0 \sim N(\hat y_0, \sigma^2(1+h_{00}))$$

$$\frac{y_0-\hat y_0}{\hat\sigma\sqrt{1+h_{00}}} \sim t(n-2) \qquad \frac{\hat y-y_0}{\hat\sigma\sqrt{1+h_{00}}} \sim t(n-2)$$

$$h_{00} = \frac{1}{n}+\frac{(x_0-\bar x)^2}{l_{xx}}$$

$$h_{00} = \frac{(x_0-\bar x)^2}{l_{xx}}+\frac{1}{n}$$

$$\cancel{SS_R = SS_T - S}$$

$$t^2 \sim F(1,n)$$

扫描全能王 创建

C7:

(1) $\hat\beta_1 = \frac{l_{xy}}{l_{xx}} = \frac{\sum x_i y_i - n\bar{x}\bar{y}}{\sum x_i^2 - n\bar{x}^2}$

$\hat\beta_0 = \bar{y} - \hat\beta_1 \bar{x}$

渐近性质

$\hat\beta_0 \sim N(\beta_0, (\frac{1}{n} + \frac{(\bar{x})^2}{l_{xx}})\sigma^2)$

$\hat\beta_1 \sim N(\beta_1, \sigma^2 \frac{1}{l_{xx}})$ $Cov(\hat\beta_0, \hat\beta_1) = -\frac{\bar{x}}{l_{xx}} \sigma^2$

$\frac{(n-2)\hat\sigma^2}{\sigma^2} \sim \chi^2(n-2)$ $\hat\sigma^2$与$(\hat\beta_0, \hat\beta_1)$相互独立

* 最小二乘性质:{

(2) 显著性检验:

$SS_e = \sum (y_i - \hat{y}_i)^2 = \sum (y_i - \hat\beta_0 - \hat\beta_1 x_i)^2 = \sum (y_i^2 + (\hat\beta_0 + \hat\beta_1 x_i)^2 - 2y_i(\hat\beta_0 + \hat\beta_1 x_i))$

$\hat\sigma = \sqrt{\frac{SS_e}{n-2}}$

$= \sum y_i^2 + \sum(\hat\beta_0^2 + \hat\beta_1^2 x_i^2 + 2\hat\beta_0\hat\beta_1 x_i) - 2\sum(y_i\hat\beta_0 + y_i\hat\beta_1 x_i)$

$= \sum y_i^2 + n\hat\beta_0^2 + \hat\beta_1^2 \sum x_i^2 + 2\hat\beta_0\hat\beta_1 \sum x_i - 2\hat\beta_0 \sum y_i - 2\hat\beta_1 \sum x_i y_i$

不能用

$SS_R = \hat\beta_1^2 l_{xx}$ 当 H_0 为真 ($H_0: \beta_1 = 0$) $\frac{SS_R}{\sigma^2} \sim \chi^2(1)$ 又因: 但课件用的是 △

$F = \frac{SS_R}{SS_E/(n-2)} \sim F(1, n-2)$ $P(F \geq F_\alpha(n-2)) = \alpha$ 拒绝域 $(F_\alpha(1, n-2), +\infty)$

$= \frac{SS_R}{\hat\sigma^2}$

当F大于$F_\alpha(1, n-2)$时, x, y有显著的线性关系.

(3) 区间预测:

(3.1)

回归系数假设检验、置信区间:

$T = \frac{\hat\beta_1 - \beta_1}{\sqrt{\frac{\hat\sigma^2}{l_{xx}}}} = \frac{(\hat\beta_1 - \beta_1)\sqrt{l_{xx}}}{\hat\sigma} \sim t(n-2)$

$P(|\frac{(\hat\beta_1 - \beta_1)\sqrt{l_{xx}}}{\hat\sigma}| < t_{\frac{\alpha}{2}}(n-2)) = 1-\alpha$

$T = \frac{\hat\beta_0 - \beta_0}{\hat\sigma\sqrt{\frac{1}{n} + \frac{\bar{x}^2}{l_{xx}}}} \sim t(n-2)$

$P(|\frac{\hat\beta_0 - \beta_0}{\hat\sigma\sqrt{\frac{1}{n} + \frac{\bar{x}^2}{l_{xx}}}}| < t_{\frac{\alpha}{2}}(n-2)) = 1-\alpha$

区间预报:

$T = \frac{y_0 - \hat{y}_0}{\sqrt{1+h_{00}}\,\hat\sigma} \sim t(n-2)$

$h_{00} = \frac{1}{n} + \frac{(x_0 - \bar{x})^2}{l_{xx}}$

$r = \frac{l_{xy}}{\sqrt{l_{xx} l_{yy}}} = \hat\beta_1 \sqrt{\frac{l_{xx}}{l_{yy}}}$

H_0为真 $r \sim r(n-2)$

$P(|r| \geq r_{\frac{\alpha}{2}}(n-2)) = \alpha$

$R^2 = r^2 = \frac{SS_R}{SS_T} = \frac{\hat\beta_1^2 l_{xx}}{l_{yy}}$

$r = \frac{1}{1 + \frac{n-2}{F}}$

$\hat\beta_0 \sim N(\beta_0, (\frac{1}{n} + \frac{(\bar{x})^2}{l_{xx}})\sigma^2)$

$\hat\beta_1 \sim N(\beta_1, \frac{\sigma^2}{l_{xx}})$

最小二乘估计的性质.

$$\hat{\beta}_1 = \cancel{\theta}\ \sum a_i y_i$$

$$a_i = \frac{x_i - \bar{x}}{l_{xx}}$$

$$\sum a_i = 0$$

$$\hat{\beta}_0 = \sum \left(\frac{1}{n} - a_i \bar{x}\right) y_i$$

C6: 方差分析

单因子:

$$SS_T = SSt + SSe \;\; \overset{\sum\limits_{i}^{k}\sum\limits_{j}^{n}(x_{ij}-\bar{x}_{..})^2}{\|}$$

$$SSt = \sum\sum (x_{ij})^2 - C \overset{-SSe}{=} n\sum_{i=1}^{k}(\bar{x}_{i.} - \bar{x}_{..})^2$$

$$F = \frac{\cancel{SS}MSt}{MSe}$$

$$SSe = \cancel{\sum_{i=1}^{k}(x_{i.})^2 - C} = \sum_{i=1}^{k}\sum_{j=1}^{n}(x_{ij} - \bar{x}_{i.})^2$$

$$C = \frac{(x_{..})^2}{nk}$$

k个处理 n次重复.

$$df_t = k-1$$

$$df_e = nk-k$$

H_0成立之前提下:

$$\frac{SSt}{\sigma^2} \sim \chi^2(k-1)$$

$$\frac{SSe}{\sigma^2} \sim \chi^2(nk-k)$$

$$F = \frac{MSt}{MSe} \sim F(k-1, nk-k)$$

$$SSt = n\sum_{i=1}^{k}(\bar{x}_{i.} - \bar{x}_{..})^2 = \sum\sum(x_{ij})^2 - C - SSe$$

$$SSe = \sum\sum(x_{ij} - \bar{x}_{i.})^2 \cancel{= \sum_{i=1}^{k}(x_{i.})^2} - C$$

$$C = \frac{(x_{..})^2}{nk}$$

$$\begin{cases} SS_T = \sum\sum x_{ij}^2 - C \\ SSt = \frac{1}{n}\sum x_{i.}^2 - C \\ SSe = SS_T - SSt \end{cases}$$

$$df_t = k-1$$

$$df_e = nk-k$$

$$MSt = \frac{SSt}{df_t}$$

$$MSe = \frac{SSe}{df_e}$$

$$MS = \frac{SS}{df}$$

双正态抽样分布定理:

数理统计需要背的.

C7

$$l_{xx} = \sum x_i^2 - n(\bar{x})^2 = \sum (x_i-\bar{x})^2 \qquad \hat{\beta}_1 = \frac{\sum x_i y_i - n\bar{x}\bar{y}}{\sum x_i^2 - n\bar{x}^2}$$

$$l_{xy} = \sum x_i y_i - n\bar{x}\bar{y} = \sum (x_i-\bar{x})(y_i-\bar{y}) = \sum_{i=1}^{n} (x_i-\bar{x}) y_i$$

线性性

$$\hat{\beta}_1 = \frac{l_{xy}}{l_{xx}} \left(= \frac{\sum (x_i-\bar{x})(y_i-\bar{y})}{\sum (x_i-\bar{x})^2} = \sum \left(\frac{x_i - \bar{x}}{l_{xx}} \right) y_i = \sum a_i y_i \right)$$

$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}$$

$$\hat{\sigma}^2 = \frac{1}{n-2} \sum_{i=1}^{n} (y_i - \hat{y}_i)^2$$

$$\hat{\sigma} = \sqrt{\frac{S_e}{n-2}}$$

$$S_e = \sum (y_i - \hat{y}_i)^2 = \sum y_i^2 + \hat{y}_i^2 - 2y_i\hat{y}_i = \sum y_i^2 + \sum \hat{y}_i^2 - 2\sum y_i \hat{y}_i$$

$$= \sum y_i^2 + \sum \hat{y}_i^2 - 2\sum y_i (\hat{\beta}_0 + \hat{\beta}_1 x_i)$$

$$= \sum y_i^2 + \sum (\hat{\beta}_0^2 + \hat{\beta}_1 x_i^2 + 2\hat{\beta}_0 \hat{\beta}_1 x_i) - 2\hat{\beta}_0 \sum y_i - 2\hat{\beta}_1 \sum x_i y_i$$

$$= \sum y_i^2 + n\hat{\beta}_0^2 + \hat{\beta}_1 \sum x_i^2 + 2\hat{\beta}_0 \hat{\beta}_1 \sum x_i - 2\hat{\beta}_0 \sum y_i - 2\hat{\beta}_1 \sum x_i y_i$$

$$S_R = \hat{\beta}_1^2 l_{xx} = \sum_{i=1}^{n} (\hat{y}_i - \bar{y})^2$$

卡西欧:

$$\sigma^2 x = \frac{\sum (x_i - \bar{x})^2}{n} \quad \text{总体方差}$$

$$s^2 x = \frac{\sum (x_i - \bar{x})^2}{n-1} \quad \text{样本方差}$$

区间预测

$$t = \frac{y_0 - \hat{y}_0}{\hat{\sigma}\sqrt{1+h_{00}}}$$

$$h_{00} = \frac{1}{n} + \frac{(x_0 - \bar{x})^2}{l_{xx}}$$

相关系数检验法

$$r = \frac{1}{1 + \frac{n-2}{F}}$$

$$r = \frac{l_{xy}}{\sqrt{l_{xx} l_{yy}}} = \hat{\beta}_1 \sqrt{\frac{l_{xx}}{l_{yy}}} \qquad R^2 = r^2 = \frac{SSR}{SST}$$

$$SSR = \sum (\hat{y}_i - \bar{y})^2$$

$$SST = SSR + SSE$$

$$SSE = \sum (y_i - \hat{y}_i)^2$$

$$r \sim r(n-2)$$

	期望	方差
0-1分布 $B(1,p)$	p	np
二项分布 $B(n,p)$ $p_k = C_n^k p^k (1-p)^{n-k}$ $(k=0,1,\dots,n)$ $p\in(0,1)$	np	$np(1-p)$
泊松分布 $P(\lambda)$	λ	λ
均匀分布 $U(a,b)$ $f(x)=\frac{1}{b-a}$	$\frac{(a+b)}{2}$	$\frac{(a-b)^2}{12}$
正态 $N(\mu,\sigma^2)$ $f(x)=\frac{1}{\sqrt{2\pi}\sigma}e^{-\frac{(x-\mu)^2}{2\sigma^2}}$ $-\infty<x<+\infty$ $\sigma>0$	μ	σ^2
指数 $f(x)=\begin{cases}\lambda e^{-\lambda x} & x>0\\ 0 & x\le 0\end{cases}$ $\cancel{x>0}$ 或 $f(x)=\begin{cases}\frac{1}{\theta}e^{-\frac{x}{\theta}} & x>0\\ 0 & x\le 0\end{cases}$ $\lambda=\frac{1}{\theta}$	$\frac{1}{\lambda}$ (θ)	$\frac{1}{\lambda^2}$ (θ^2)
χ^2分布 $\chi^2(n)$	n	$2n$
t分布 $t(n)$ $X\sim N(0,1)$ $Y\sim\chi^2(n)$ $t=\frac{X}{\sqrt{\frac{Y}{n}}}$	0	$\frac{n}{n-2}$

需要省的?

$f = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$ $\quad \ln f = \ln\frac{1}{\sqrt{2\pi}} + \ln\frac{1}{\sigma} - \frac{(x-\mu)^2}{2\sigma^2}$ $\quad \frac{\partial \ln f}{\partial \sigma} = -\frac{1}{\sigma} + \frac{(x-\mu)^2}{\sigma^3}$

$I(\sigma) = -E\left(\frac{\partial \ln f}{\partial \sigma^2}\right) = -E\left(\frac{1}{\sigma^2} - \frac{3(x-\mu)^2}{\sigma^4}\right)$ $\quad \frac{\partial^2 \ln f}{\partial \sigma^2} = \frac{1}{\sigma^2} - \frac{3(x-\mu)^2}{\sigma^4}$

$= -\frac{1}{\sigma^2} + 3E\left(\frac{(x-\mu)^2}{\sigma^4}\right)$ $\quad E(x^2) = \overset{\mu^2}{(E(x))^2} + \overset{\sigma^2}{Var(x)}$

$= -\frac{1}{\sigma^2} + 3E\left(\frac{x^2 - 2\mu x + \mu^2}{\sigma^4}\right)$ $\quad \cancel{Var(x^2)}$

$= -\frac{1}{\sigma^2} + 3\frac{\mu^2 + \sigma^2 - 2\mu^2 + \mu^2}{\sigma^4}$ $\quad E(x^2) =$

$Var(x^2) = E(x^4) - [E(x^2)]^2$

$= \frac{2}{\sigma^2}$ $\quad Var(x) = \sigma^2$; $E(x) = \mu$ $\quad E(x^2) = \sigma^2 + \mu^2$

$Var(x^2) =$ $\quad E(x^4) = (E(x^2))^2 + Var(x^2)$

$= (\sigma^4$

$E(x^4)$ 用公式

$\cancel{I(\sigma)} =$

$Var(\hat\sigma) = Var\left(\sqrt{\frac{1}{n-1}\sum_{i=1}^n (x_i - \bar x)^2}\right) = Var\left(\sqrt{\frac{1}{n-1}\left(\sum_{i=1}^n x_i^2 + \sum_{i=1}^n \bar x^2 - 2\sum_{i=1}^n x_i \bar x\right)}\right)$

$\hat\sigma = \frac{1}{n-1}\sum_{i=1}^n (x_i - \bar x)^2$ $\quad = Var\left(\sqrt{\frac{1}{n-1}\left(\sum_{i=1}^n x_i^2 + n\bar x^2 - 2n\bar x^2\right)}\right)$

$= Var\left(\sqrt{\frac{1}{n-1}\left(\sum_{i=1}^n x_i^2 - n\bar x^2\right)}\right)$

$f = \frac{1}{\sqrt{2\pi}\, t^{\frac12}} e^{-\frac{(x-\mu)^2}{2t}}$

$\cancel{I(\sigma^2) =}$ $\quad =$

$\ln f = \ln\frac{1}{\sqrt{2\pi}} + \ln\frac{1}{t^{\frac12}} - \frac{(x-\mu)^2}{2t}$

不是有效估计

$\frac{\partial \ln f}{\partial t} = -\frac{1}{2}\frac{1}{t} + \frac{(x-\mu)^2}{2t^2}$

$\frac{\partial^2 \ln f}{\partial t^2} = \frac{1}{2}\frac{1}{t^2} - \frac{(x-\mu)^2}{t^3}$

$t = \sigma^2$

$I(t) = -E\left(\frac{\partial^2 \ln f}{\partial t^2}\right) = -E\left(\frac12\frac{1}{t^2} - \frac{(x-\mu)^2}{t^3}\right)$ $\quad \frac{\left(\frac{n-1}{n}\right)^2\sigma^2 + \frac{n-1}{n^2}\sigma^2}{}$

$= -\frac12 E\left(\frac{1}{t^2}\right) + E\left(\frac{(x-\mu)^2}{t^3}\right)$

$x_i - \frac{\sum x_i}{n} = \frac{n x_i - \sum x_j}{n} = \frac{(n-1)x_i - \sum_{j\neq i} x_j}{n}$

$= -\frac{1}{2t^2} + \frac{1}{t^2}$ $\quad \|$

$x_i - \bar x \sim N(0, \sigma^2)$ $\quad \cancel{\frac{x_i - \bar x}{\sigma} \sim N(0,1)}$

$= \frac{1}{2t^2}$ $\boxed{Var(\hat\sigma^2) = \frac{1}{nI(\sigma^2)}} = \frac{2\sigma^4}{n}$ $\quad \frac{(n-1)s^2}{\sigma^2} \sim \chi^2(n-1)$ $\quad \frac{(n-1)^2}{\sigma^4} Var(s^2) = 2(n-1)$

$Var(\hat\sigma^2) = Var\left(\frac{1}{n-1}\sum_{i=1}^n (x_i - \bar x)^2\right) = Var\left(\frac{1}{n-1}\left(\sum_{i=1}^n x_i^2 - n\bar x^2\right)\right)$ $\quad Var(s^2) = \frac{2\sigma^4}{(n-1)}$

$= \frac{1}{(n-1)^2}\left[n Var(x^2) - n^2 Var(\bar x^2)\right]$ $\quad > \frac{2\sigma^4}{n}$

$F=\dfrac{MSt}{MSe}$

		$E(X)$	$D(X)$	概率密度 $f(x)$、分布列 $p(X=k)$
均匀分布	$U(a,b)$	$\dfrac{a+b}{2}$	$\dfrac{(a-b)^2}{12}$	$f(x)=\dfrac{1}{b-a}$
二项	$B(n,p)$	np	$np(1-p)$	$p(X=k)=C_n^k p^k (1-p)^{n-k}$
0-1	$B(1,p)$	p	$p(1-p)$	$k=0,1$ $p(X=k)=C_1^k p^k (1-p)^{1-k}$
几何分布	$GE(p)$	$\dfrac{1}{p}$	$\dfrac{1-p}{p^2}$	$p(X=k)=(1-p)^{k-1}p$
超几何分布	$H(n,M,N)$ M件不合格品 共N件待检 随机抽n件，抽出k件不合格概率	$\dfrac{nM}{N}$	$\dfrac{nM}{N}\left(1-\dfrac{M}{N}\right)\dfrac{N-n}{N-1}$	$p(X=k)=\dfrac{C_M^k C_{N-M}^{n-k}}{C_N^M}$ $(k=0,1,2,\dots,\min\{n,M\})$
正态	$N(\mu,\sigma^2)$	μ	σ^2	$f(x)=\dfrac{1}{\sqrt{2\pi}\sigma}e^{-\frac{(x-\mu)^2}{2\sigma^2}}$
指数	$E(\lambda)$	$\dfrac{1}{\lambda}$	$\dfrac{1}{\lambda^2}$	$f(x)=\begin{cases}\lambda e^{-\lambda x} & x>0\\ 0 & x\le 0\end{cases}$
χ^2分布	$\chi^2(n)$	n	$2n$	$\chi^2(n)=X_1^2+X_2^2+\dots X_n^2$