uniform distribution: (minimum, maximum)

probability density function (PDF) $\begin{cases} \frac{1}{max-min} & min \le x \le max \\ 0 & (otherwise) \end{cases}$

cumulative distribution function (CDF) $P(X \le x) = \begin{cases} \frac{x - min}{max - min} & min \le x \le max \\ 1 & x > max \end{cases}$

poisson distribution: (mean $= \lambda$)

pdf: $P(X = x) = \begin{cases} \frac{e^{-\lambda}\lambda^x}{x!} & (x \ge 0) \\ 0 & (otherwise) \end{cases}$

cdf: $P(X \le x) = \begin{cases} Q(\lfloor x \rfloor + 1, \lambda) & x \ge 0 \\ 0 & (otherwise) \end{cases}$ ($\lfloor x \rfloor$ is a floor function, $Q(a, x)$ is the regularized incomplete grammar function)

binomial distribution: (number of trials "n" (positive integer), probability of success "p" (0 or 1))

pdf: $P(X = x) = \begin{cases} p^x \binom{n}{x} (1-p)^{n-x} & 0 \le x \le n \\ 0 & (otherwise) \end{cases}$ $\binom{n}{m}$ is the binomial coefficient

cdf: $P(X = x) = \begin{cases} I_{1-p}(n - \lfloor x \rfloor, \lfloor x \rfloor + 1) & 0 \le x < n \\ 1 & x \ge n \end{cases}$ $I_z(a, b)$ is the regularized incomplete beta function

exponential distribution: (rate "λ" (positive))

pdf: $\begin{cases} \lambda e^{\lambda(-x)} & x \ge 0 \\ 0 & otherwise \end{cases}$

cdf: $\begin{cases} 1 - e^{\lambda(-x)} & x \ge 0 \\ 0 & otherwise \end{cases}$

z distribution: (mean: $\mu = 0$) (standard deviation: $\sigma = 1$)

pdf: $\frac{e^{\frac{-x^2}{2}}}{\sqrt{2\pi}}$

z score: $z = \frac{(x - \mu)}{\sigma} = \frac{(6-5)}{4} = 0.25$ 然后去 normal table 查相应数字

cdf: $P(X \le x) = \int_{-\infty}^{x} \frac{e^{-(\frac{x^2}{2})}}{\sqrt{2\pi}} = \frac{1}{2}\text{erfc}\left(-\frac{x}{\sqrt{2}}\right)$

t distribution: (ν (positive))

pdf: $\frac{\left(\frac{\nu}{\nu + x^2}\right)^{(\nu+1)/2}}{\sqrt{\nu}\, B(\nu/2, 1/2)}$ $B(a, b)$ is the beta function

cdf: $P(X \le x) = \begin{cases} \frac{1}{2} I_{\frac{v}{x^2+v}}\left(\frac{v}{2}, \frac{1}{2}\right) & x \le 0 \\ \frac{1}{2}\left(I_{\frac{x^2}{x^2+v}}\left(\frac{1}{2}, \frac{v}{2}\right) + 1\right) & \text{(otherwise)} \end{cases}$

confidence intervals: (with t distribution?)

$$x \pm \frac{t_{(1-c/2)}\, S}{\sqrt{n}}$$

($t_{(1-c/2)}$ → t table 查詢)

n: sample size
s: sample standard deviation
x: sample mean
c: confidence level

confidence intervals for proportion:

$$\hat{p} \pm \sqrt{\frac{(1-\hat{p})\hat{p}}{n}}\; Z_{(1-c/2)}$$

$\hat{p}$: sample proportion
n: sample size
C: confidence level

↓

$$\hat{p} \pm (CV) \cdot SE(\hat{p})$$

CV → confidence value
SE → standard error

Confidence Intervals for z distribution:

example: (95% CI) $\mu \pm 1.96 \frac{\sigma}{\sqrt{n}}$

μ: mean
σ: standard deviation
size: n

Confidence Intervals for t distribution:

- α-level = 1 − desired confidence level
- df (degree of freedom) = sample size −1

Z-test:
normal proportion
population standard deviation

t-test:
normal proportion
larger sample size

Test statistic: $\frac{\bar{x} - \mu_0}{\frac{sd}{\sqrt{n}}}$

μ_0 = H_0 value for population mean
$\bar{x}$ = sample mean
n = sample size
sd = population sd