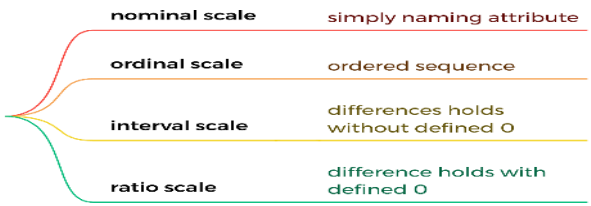
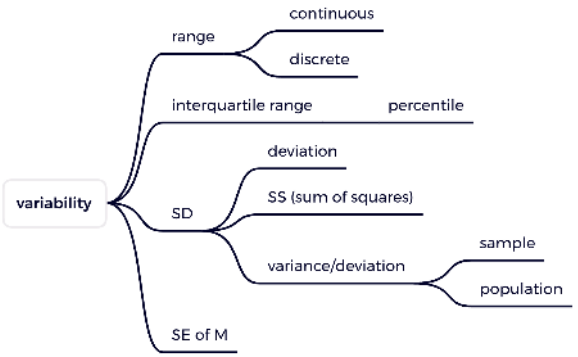
✓ Scale of measurement



✓ Variability



> z-score: $z = \frac{x-\mu}{\sigma}$

✓ Bayes theorem: $P(A|B) = \frac{P(B|A)P(A)}{P(B|A)P(A)+P(B|A^C)P(A^C)}$

✓ Distributions

Binomial $X \sim B(n,p)$	$P(x) = C_n^x p^x (1-p)^{n-x}$	$E(X) = np$, $Var(X) = np(1-p)$
Normal distribution $X \sim N(\mu, \sigma^2)$	$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2\sigma^2}(x-\mu)^2}$	$E(X) = \mu$ $Var(X) = \sigma^2$
Exponential distribution	$f(x) = \lambda e^{-\lambda x}$, $for\ x > 0, \lambda > 0$	$E(X) = \lambda^{-1}$ $Var(X) = \lambda^{-2}$
Poisson distribution	$P(k\ events) = \frac{\lambda^k e^{-\lambda}}{k!}$	$E(X) = \lambda$ $Var(X) = \lambda$
t distribution	$X_i \sim N(\mu, \sigma^2)$, then $\frac{\sqrt{n}(\bar{X}_n - \mu)}{S} \sim t_{n-1}$	

Uniform distribution

✓ CLT: $\bar{X}_n \sim N\left(\mu, \frac{\sigma^2}{n}\right), E(X) = \mu, Var(X) = \sigma^2$

✓ LLN (law of large number): the larger the sample size n, the closer $\bar{X}_n$ be to the population mean.

✓ Hypothesis testing

	H_0 True	H_0 False
H_1 True	No error $1-\alpha$	Type II error β
H_1 False	Type I error α	No error $1-\beta$

> α and β: inversely correlated, reduced with greater n

✓ Power

Null Hypothesis	Power	Target Sample Size
$H_0: \mu < \mu_0$ $H_0: \mu > \mu_0$	$\phi(z_\alpha + \frac{\lvert\mu_0 - \mu_1\rvert}{\sigma/\sqrt{n}})$	$n = \frac{(z_{1-\beta} + z_{1-\alpha})^2 \sigma^2}{(\mu_0 - \mu_1)^2}$
$H_0: \mu = \mu_0$	$\approx \phi(z_{\frac{\alpha}{2}} + \frac{\lvert\mu_0 - \mu_1\rvert}{\sigma/\sqrt{n}})$	$n = \frac{(z_{1-\beta} + z_{1-\alpha/2})^2 \sigma^2}{(\mu_0 - \mu_1)^2}$

> factors

Significance level, α	−
Effect size (Alternative mean and null mean)	+
Measuring error (SD)	−
Sample size	+

✓ Effect size: depends on size of effect & size of sample

$$Cohen's\ d = \frac{M-\mu}{\sigma} (\sigma \xrightarrow{t\ test} s)$$

> Measuring effect size with t statistic

$$percentage\ of\ variance\ accounted\ for = r^2 = \frac{t^2}{t^2 + df}$$

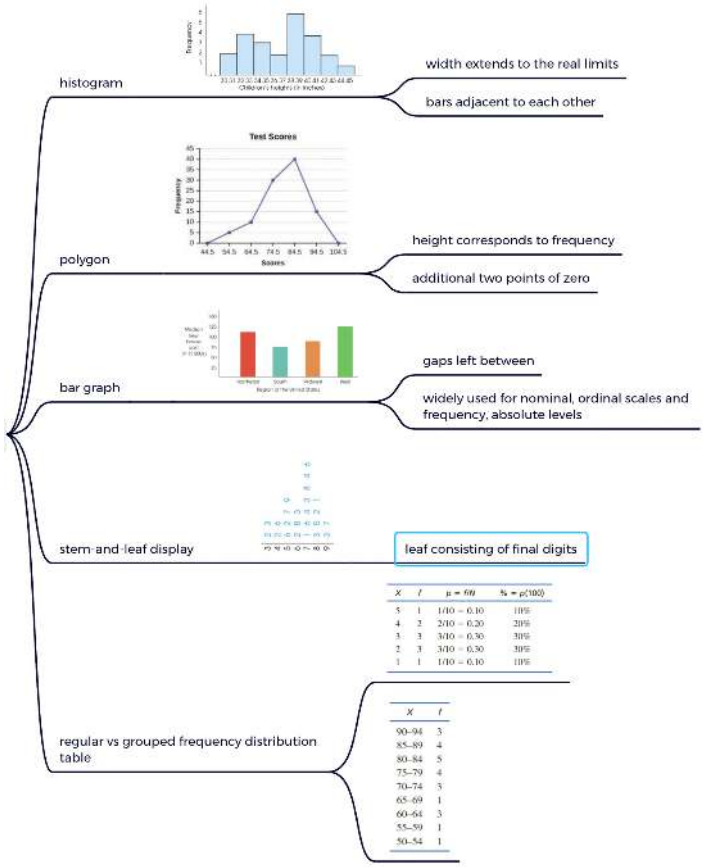
✓ Z-test: $z = \frac{M-\mu}{SEM}$

✓ Paired t test

$$D_i = X_{2i} - X_{1i} \sim N(\Delta, \sigma_D^2)$$

$$t = \frac{M_D - \mu_D}{s_{MD}}$$

✧ Plots



✧ Concepts:

Parameter, statistic, real limits (URL, LRL), apparent limits, range. PMF, CDF, PDF

Percentile (from lower), distribution of sample means.

连续函数刻画离散问题时，注意精确上下限！