

Formula Sheet

Descriptive Statistics

$$\text{sample mean} = \bar{x} = \frac{\sum x_i}{n} \quad \text{Sample Standard Deviation } s_x = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

Probability

Disjoint outcomes $P(A \text{ or } B) = P(A) + P(B)$

If not Disjoint outcomes $P(A \text{ or } B) = P(A) + P(B) - P(A \cap B)$

Independent processes $P(A \text{ and } B) = P(A) * P(B)$

$$\text{Conditional Probability} \quad P(A | B) = \frac{P(A \cap B)}{P(B)}$$

Distribution	PROBABILITY	Mean	Standard Deviation
Binomial	${}^n C_k p^k (1-p)^{n-k}$	np	$\sqrt{np(1-p)}$
Geometric	$(1-p)^{n-1}p$	$\frac{1}{p}$	$\sqrt{\frac{1-p}{p^2}}$

Normal Distribution

$$\text{Z score} = \frac{x - \mu}{\sigma}$$

Inferential Statistics

Z Distribution

$$Z = \frac{\bar{X} - \alpha_{\bar{X}}}{S_{\bar{X}}} = \frac{\bar{X} - \alpha}{\frac{S}{\sqrt{n}}}$$

$$\text{Confidence Interval} = \text{sample statistic} \pm z^* * \frac{\sigma}{\sqrt{n}}$$

T Distribution

One sample (n-1 degrees of freedom)

$$t = \frac{\bar{X} - \alpha_{\bar{X}}}{s_{\bar{X}}} = \frac{\bar{X} - \alpha}{\frac{s}{\sqrt{n}}}$$

$$\text{Confidence Interval} = \text{sample statistic} \pm t^* * \frac{s}{\sqrt{n}}$$

Dependent sample t-test (n-1 degrees of freedom)

$$t_{\bar{D}} = \frac{\bar{D} - 0}{\frac{s_D}{\sqrt{n}}}$$

$$\text{Confidence Interval} = \text{sample statistic (i.e. difference)} \pm t^* * \frac{s_D}{\sqrt{n}}$$

Independent samples t-test ($n_1 + n_2 - 2$ degrees of freedom)

$$t = \frac{(\bar{X}_1 - \bar{X}_2)}{s_{\bar{X}_1 - \bar{X}_2}} = \frac{(\bar{X}_1 - \bar{X}_2)}{\sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}}} = \frac{(\bar{X}_1 - \bar{X}_2)}{\sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2} \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}}$$

Single Proportion

$$z = \frac{\text{point estimate} - \text{null value}}{SE}$$

$$SE = \sqrt{\frac{p_0(1-p_0)}{n}}$$

$$\text{Confidence Interval} = \text{sample statistic} \pm z^* * SE$$

Difference of proportions

point estimate is the difference between two groups

$$z = \frac{\text{point estimate} - \text{null value}}{SE}$$

$$SE = \sqrt{\frac{p_1(1-p_1)}{n_1} + \frac{p_2(1-p_2)}{n_2}}$$

$$\text{Confidence Interval} = \text{sample statistic} \pm z^* * SE$$

ANOVA

$$F = \frac{\text{Between Treatment Variability}}{\text{Within Treatment Variability (error)}}$$

$$F = \frac{MS_{\text{between}}}{MS_{\text{within}}}$$

$$MS_{\text{between}} = \frac{SS_{\text{between}}}{df_{\text{between}}}$$

$$MS_{\text{within}} = \frac{SS_{\text{within}}}{df_{\text{within}}}$$

Chi-Square

$$\chi^2 = \sum_{i=1}^k \frac{(O - E)^2}{E} \quad \text{where } k = \text{total number of cells}$$
