Formula Sheet

Descriptive Statistics

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

Probability

Disjoint outcomes P(A or B) = P(A) + P(B)

If not Disjoint outcomes P(A or B) = P(A) + P(B) – P(A $\cap$ B)

Independent processes P(A and B) = P(A) * P(B)

Conditional Probability $P(A \mid B) = \frac{P(A \cap B)}{P(B)}$

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

Normal Distribution

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

Inferential Statistics

Z Distribution

$$z = \frac{\bar{X} - \mu_{\bar{X}}}{\sigma_{\bar{X}}} = \frac{X - \mu}{\frac{\sigma}{\sqrt{n}}}$$

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

T Distribution

One sample (n-1 degrees of freedom)

$$t = \frac{\bar{X} - \mu_{\bar{X}}}{s_{\bar{X}}} = \frac{X - \mu}{\frac{s}{\sqrt{n}}}$$

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

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

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

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

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

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

Single Proportion

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

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

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

Difference of proportions

point estimate is the difference between two groups

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

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

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