Chapter 9

• Binomial data $X \sim \text{binomial}(n, p)$. Confidence interval for p

$$\left[\frac{X}{n} - z_{\alpha/2}\sqrt{\frac{X(n-X)}{n^3}}, \frac{X}{n} + z_{\alpha/2}\sqrt{\frac{X(n-X)}{n^3}}\right].$$

• Binomial data, two variables $X \sim \text{binomial}(n, p_X)$, $Y \sim \text{binomial}(m, p_Y)$, X and Y are independent. Confidence interval for $p_X - p_Y$

$$\left[\frac{X}{n} - \frac{Y}{m} - z_{\alpha/2}\sqrt{\frac{X(n-X)}{n^3} + \frac{Y(m-Y)}{m^3}},\right.$$

$$\left.\frac{X}{n} - \frac{Y}{m} + z_{\alpha/2}\sqrt{\frac{X(n-X)}{n^3} + \frac{Y(m-Y)}{m^3}}\right].$$

• $X_1, ..., X_n$ are normally distributed. $(1-\alpha)$ confidence interval for σ^2

$$\left[\frac{(n-1)S^2}{\chi^2_{\alpha/2}}, \frac{(n-1)S^2}{\chi^2_{1-\alpha/2}}\right].$$

• Two samples. Confidence interval for the ratio of two variances σ_1^2/σ_2^2

$$\left[\frac{S_1^2}{S_2^2}\frac{1}{f_{\frac{\alpha}{2},n_1-1,n_2-1}}, \frac{S_1^2}{S_2^2} f_{\frac{\alpha}{2},n_2-1,n_1-1}.\right]$$

• Maximum likelihood estimator

$$\hat{\theta} : \quad L(X_1, ..., X_n) \to \max$$

where L is the likelihood function.

Chapter 10

• A statistical hypothesis is an assertion or conjecture concerning one or more populations.

It is formulated as one assertion against another assertion, that is there are a null hypothesis H_0 and an alternative hypothesis H_1.

Decisions: a) H_0 is rejected, b) H_0 is not rejected.

• A test: the test statistic (a function of the data) and the critical region. If the test statistic belongs to the critival region, H_0 is rejected.

	H_0 is true	H_0 is false
H_0 is rejected	Type I error	Correct decision
H_0 is not rejected	Correct decision	Type II error

The level of significance is $\alpha = P(\text{Type I error})$. The power is $1 - \beta$ where $\beta = P(\text{Type II error})$.