Interval estimation

$\bar{X} \pm 1.96 \frac{\sigma}{\sqrt{n}}$ define the confidence interval

- CI's for means for means and proportions typically have a similar structure
  - Centred at sample statistics
  - Endpoints are +- some multiple of the standard error (if we don't know sigma) or standard deviation (if we do know sigma) of the sampling distribution
  - 'Multiple' determined by confidence interval

Selecting a sample size

$$\bar{X} \pm z_{\alpha/2} \frac{\sigma}{\sqrt{n}} \text{ defines the confidence interval}$$

$$\text{Thus we require } z_{.05} \frac{\sigma}{\sqrt{n}} = 4$$

e.g.

$$\text{or } \sqrt{n} = \frac{1.645 \times 30.334}{4} \Rightarrow n \approx 156$$

p-values

The p-value associated with a given test statistic is the probability of obtaining a value of the test statistic as or more extreme than that observed, given that the null hypothesis is true

$$p - value = P(\bar{X} > 7.09)$$

$$= P\left(\frac{\bar{X} - \mu}{\sigma/\sqrt{n}} > \frac{7.09 - 6.60}{1/5}\right)$$

$$= P(Z > 2.46) = .0069$$

We can only calculate this if we assume the sampling distribution of $\bar{X}$ is centred at a particular value – which we assume to be **the population mean under the null!**

Therefore, there is strong evidence to reject H_0 (would reject for any choice of significance level > 0.069)

When to use....

Sampling distribution of the **sample proportion**
- When you are testing hypotheses about the population parameter p
- When you have a binomial distribution that can be approximated to the normal $(np, nq > 10)$

The t-distribution
- When you are testing hypotheses about the population parameter μ
- When you have not been told your distribution is normal
- When you have been told your distribution is small with parameter s→σ (even if normal)

Sampling distribution of the **sample mean**
- When you are testing hypotheses about the population parameter μ
- When you have been told your distribution is approximated to the normal with parameter σ; or
- When you have been told your distribution is sufficiently large $(n > 30)$ with parameter s→σ