**Decision Errors**

| | | **Decision** | |
|---|---|---|---|
| | | fail to reject $H_0$ | reject $H_0$ |
| **Truth** | $H_0$ true | Correct Decision | Type I Error ($\alpha$) |
| | $H_A$ true | Type II error ($\beta$) | Correct Decision |

Example

# 1 Inference for a Difference of Two Proportions

## 1.1 Conditions

1. The data are independent within two groups and between two groups.
2. Each group needs to have 10 successes and 10 failures.

## 1.2 Confidence Interval

## 1.3 Hypothesis Testing

If these conditions are met then

$(\hat{p}_1 - \hat{p}_2) \sim N(p_1 - p_2, \frac{p_1(1-p_1)}{n_1}) + \frac{p_2(1-p_2)}{n_2})$

Example: Does taking a college level science class change views on after life? Below are the responses from General Social Survey in 2018.

| | | **Belief in Life After Death** | |
|---|---|---|---|
| | | Yes | No |
| **College Science Course** | Yes | 375 | 75 |
| | No | 485 | 115 |

Example: Calculate the 95% confidence interval for the difference in proportion of belief in after life between those who have taken a college science course and those who have not in the population

Example: Evaluate whether taking a college level science class change views on after life with a hypothesis test.