Midterm Cheat Sheet

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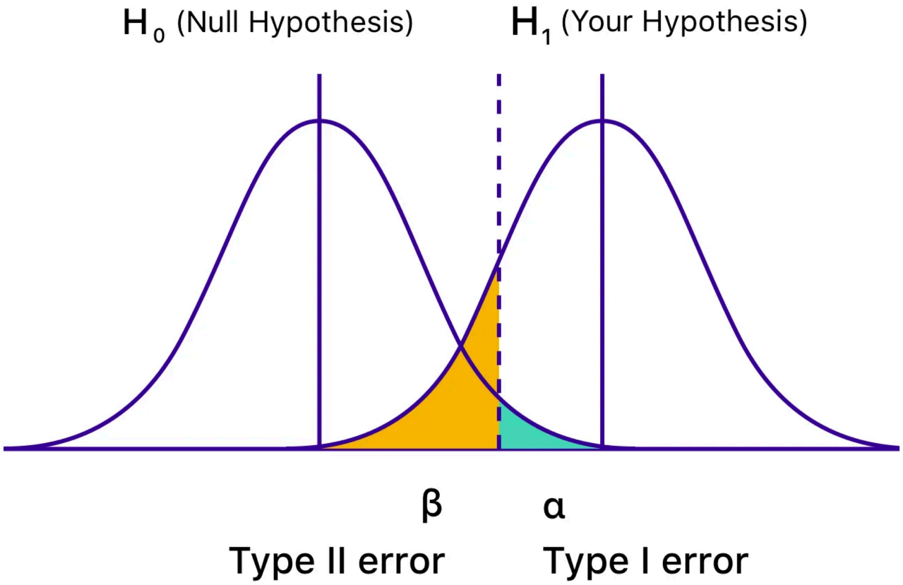
Contents

1 Type I and Type II Error, calculating power:



2 Skewness

Left (negative) skew: The left tail extends farther out than the right tail Right (positive skew): The right tail extends farther out than the left tail

3 Quantiles

3.1 Percentiles and quartiles

The p sample quantile is the value below which a proportion p of the data are located.

E.g., if your birth weight is at the 95th percentile, then you weighed more than 0.95 of all newborn babies.

IQR: Interquartile Range = Q3 - Q1

1st quartile (Q1): 25th percentile, 2nd quartile (Q2): 50th percentile (median), 3rd quartile (Q3): 75th percentile.

3.2 Modified Boxplot

An outlier is a data point that is either:

- Less than: $Q1 - 1.5 \times (Q3 - Q1)$ = lower fence of box
- Greater than: $Q3 + 1.5 \times (Q3 - Q1)$ = upper fence of boxplot

- Standard span: 1.5 × (Q3 − Q1) = 1.5 × IQR

4 Variance

5 Relationships Between Variables

Case CQ: Categorical and Quantitative

Case CC: Categorical and Categorical

Case QQ: Quantitative and Quantitative

6 Three Variables

add color as the third dimension

7 Empirical Rule

If a distribution is symmetric, unimodal, and bell-shaped (i.e., normally distributed), then the following hold:

- Approximately 68% of observations fall within one SD of the mean: x ± s, or (x − s, x + s)
- Approximately 95% of observations fall within two SDs of the mean: x ± 2s, or (x − 2s, x + 2s)
- Approximately 99.7% of observations fall within three SDs of the mean: x ± 3s, or (x − 3s, x + 3s)

8 Transformation:

8.1 Box-Cox Power Transformation

$$y_\lambda = \begin{cases} \frac{x^\lambda - 1}{\lambda}, & \lambda \neq 0 \\ \log(x), & \lambda = 0 \end{cases}$$

R code:

~~~
```r
library(MASS)
bc1 <- boxcox(x ~ 1)
bc1$x[bc1$y == max(bc1$y)]
```
~~~

~~~~
```r
# Example code from assignment
library(MASS)
bc1 <- boxcox(df$price ~ 1)
lambda <- bc1$x[bc1$y == max(bc1$y)]
trans <- (df$price^lambda - 1)/lambda
summary(trans)
```
~~~~

8.2 For right skewed data, use a function that tends to reduce larger values in proportion to smaller ones (i.e., an increasing function whose slope is decreasing):

8.2.1 Log transformation:

in R: `log()`

8.2.2 Square-root transformation:

in R: `sqrt`

9 Check normality: qqplot

in R: `qqnorm(data); qqline(data)`