$H_0$ : No one in the class
can predict the future

$H_1$ : Someone can predict the future

6 tosses .

Let A be the event of someone
guessing all 6 tosses correctly

$$P(A) = \frac{card\ A}{card\ \Omega} = \frac{1}{2^6} = \frac{1}{64}$$

$= 0.0156$

$\Omega$ - space of 6 tosses

$\frac{1}{32} = 0.03$

$\alpha = 0.05$

$p = 0.03 \qquad p < \alpha$

Class today has 58 students

Suppose there were 100 students
there would be 100 p-values

$p \sim Unif(0,1)$ under $H_0$ is true

So for 100 independent p-values
How many would you expect are less than 0.05?

let $Z$ be the number of p-values
less than $\alpha$ $(= 0.05)$

$$Z = \sum_{i=1}^{\hat{}} I(x_i < \alpha) = A_i \quad (n=100)$$

each $x_i$ is a p-value

$$I(x_i < \alpha) = \begin{cases} 1 & \text{if } x_i < \alpha \\ 0 & \text{otherwise} \end{cases}$$

$\underset{\sim U(0,1)}{\uparrow}$

each $I(x_i < \alpha) \sim Bern(\alpha)$

$$Z \sim Bin(n, \alpha) \qquad n=100 \quad \alpha = 0.05$$

$$E[Z] = n\alpha = 100 \cdot (0.05) = 5$$

$\hat{Z}$  $n = 58$

$\alpha = 0.05$

$$E[\Sigma] = 58 \cdot (0.05) = 2.9$$

$$\alpha = 0.03 \quad = 58(0.03) \Rightarrow \underline{1.74}$$

Let $A_i$ be a hypothesis test

Let $A = \overset{n}{\underset{i=1}{\cup}} A_i$

$$P(A) = P\left(\overset{n}{\underset{i=1}{\cup}} A_i\right) \leq \overset{n}{\underset{i=1}{\sum}} P(A_i)$$

Suppose $P(A_i) = \alpha$ for $i = 1, 2, \dots, n$

$$P(A) = P\left(\overset{n}{\underset{i=1}{\cup}} A_i\right) \leq \overset{n}{\underset{i=1}{\sum}} P(A_i)$$

$$= \overset{n}{\underset{i=1}{\sum}} \alpha = n\alpha$$

Need to adjust threshold $\alpha$ when there are multiple hypotheses

$$P(A) = n\alpha$$

$$\text{Let } \tilde{\alpha} = \alpha/_n \quad \leftarrow \text{ nominal threshold level}$$

$$\uparrow \text{ adjusted significance level}$$

Test $H_0$ at level $\tilde{\alpha} = \alpha/_n$
for multiple hypotheses
then the probability that at least
one individual hypothesis is rejected
is $\alpha$

# BONFERRONI CORRECTION

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$H_0$ : My colleague cannot see
the future

$H_1$ : My colleague can see
the future.

$\alpha = 0.02 \implies H_0$ rejected

# The exam

Chapter 1: Central tendency + dispersion

Chapter 2: EDA

Chapter 3: Normal random variables

Chapter 4: Hypothesis testing

<span style="color:red">Excluding one-sided hypothesis testing (Section 4.4.2)</span>

Chapter 5: Pitfalls in Statistics

Chapter 6: Covariance + Correlation

Chapter 7: Statistical models

Chapter 8: (Maximum) likelihood

Chapter 9: Simple linear regression

Excluding 10. Bayesian inference
11. Bootstrap
A. Additional details

Formula sheet?
— Term 1        3 Q
— Term 2        3 Q

Revision class(es)    3 May (Wed)