Why is "Hypothesis Testing" important?

We want to weigh up evidence to make evidence based decisions.

Hypothesis Testing Framework

S — state significance level

1. Set up research question

H — Hypotheses: H_0 vs H_1

2. Weigh up evidence

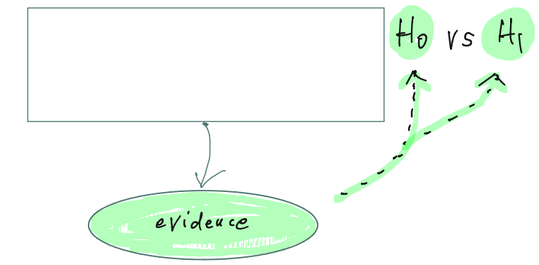
A — Assumptions

T — Test Statistic

P — p-value

3. Explain conclusion

C — In terms of p-value and context



what is the best decision?

eg/ $\alpha = 0.05$

H_0: parameter = value

H_1: parameter ≠ value ← 2 sided

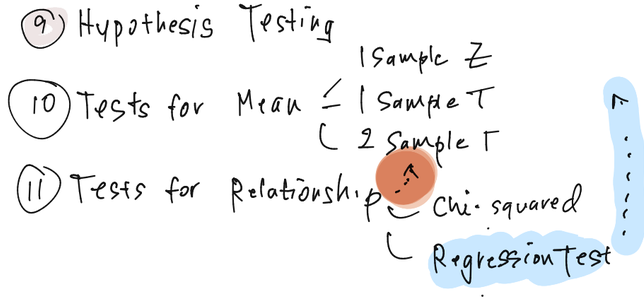
H_1: parameter > value
H_1: parameter < value
} 1 sided

state & justify

TS - measures the difference between what is observed (data) and what is expected (H_0)

$$TS = \frac{OV - EV}{SE}$$

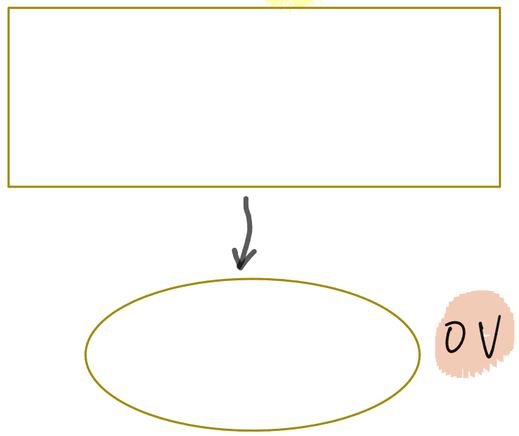
PV = chance of observing TS or something more extreme.



LO7 [capstone] Given real multivariate data and a problem, formulate an appropriate hypothesis and perform a range of hypothesis tests.

LO8 Interpret the p-value, conscious of the pitfalls associated with testing.

Assume H_0 is true



OV

Box Model

Sample Sum (or Mean) $\sim N(EV, SE^2)$

S $\alpha = 0.05$

H H_0

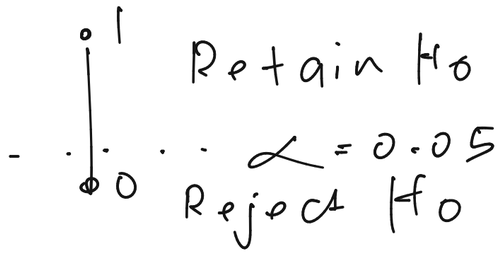
H_1

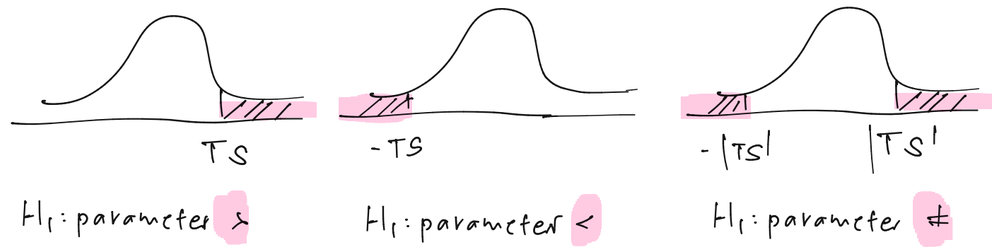
A

T $TS = \dfrac{OV - EV}{SE} = \langle number \rangle$

P $PV = P_{H_0}$ (getting TS or something more extreme)

C





H_1: parameter $>$ H_1: parameter $<$ H_1: parameter $\neq$

Summary of Hypothesis Testing – Proportion Test

Assuming H_0 is true

8×1 2×0

mean = 0.8

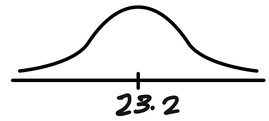
SD = 0.4 $(1-0)\sqrt{0.8\times0.2}$

n =

1 ... 0 ... 1

(sum) OV = 26

Sample Sum	EV = n mean	29×0.8 = 23.2
	SE = $\sqrt{n}$ SD	$\sqrt{29}\times0.4 \doteq 2.2$
Sample Mean	EV = mean	
	SE = $\frac{SD}{\sqrt{n}}$	



Sample Sum / Mean

N (23.2 , 2.2^2)

S

$\alpha = 0.05$

H

H_0: P(peanut desentisisation) = $p = 0.8$

H_1: $p > 0.8$

A

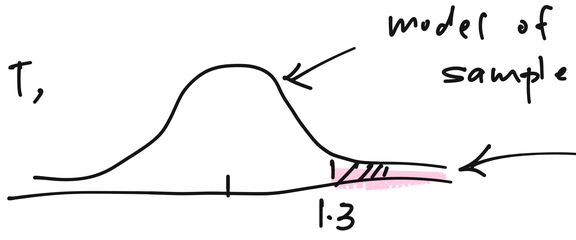
- The participants are independent of each other.
- P(desentisisation) = same for all participants.

T

$$TS = \frac{OV - EV}{SE} = \frac{26 - 23.2}{2.2} = 1.3$$

P

Using CLT,

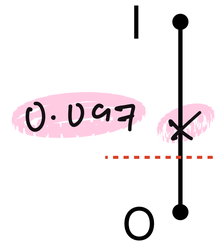


= 1 - phorm (1.3)

→ 0.097

C

Data is consistent with a desentisisation rate of 0.8



Retain H_0

$\alpha = 0.05$

CI

95% CI for sample sum:

OV ± 2 SE

26 ± 2.2.2

(21.6, 30.4) ← NB

How to simulate p-values

```
set.seed(1)
box = c(1,1,1,1,0)        ← models H0
totals = replicate(100, sum(sample(box, 29, replace=T)))
table(totals)
```

16	17	....	25	26	27	28
1	2		16	6	4	2

p-value

$$= \frac{6+4+2}{100}$$

$$= 0.12$$