

Physics 341 - Lecture 22

Assignment 5

→ Raw Data from an experiment.

	A	B	C	D
within a group (noise)	✓ — ✓ — ✓ — ✓ — ✓ — ✓ — ✓ — ✓ —	— — — — — — — —	— — — — — — — —	— — — — — — — —
	between groups (signal)			

"perfect world" → NULL HYPOTHESIS
— all data pts. to be the

same.

SS_{treatment}, SS_{error}, SS_{total}

→ Summary Statistics

$\bar{x}_A, \bar{x}_B, \bar{x}_C, \bar{x}_D$

SS_{trt.}, SS_{error} ?

MS_{trt}, MS_{error} ?

Common.

Q1.

$N_{\text{dot}}^{\text{trt}}$

$N_{\text{dot}}^{\text{error}}$

$N_{\text{dot}}^{\text{total}}$

Step 1

A

B

C

D

$a = 4$

$N_{\text{dot}} = an = 12$

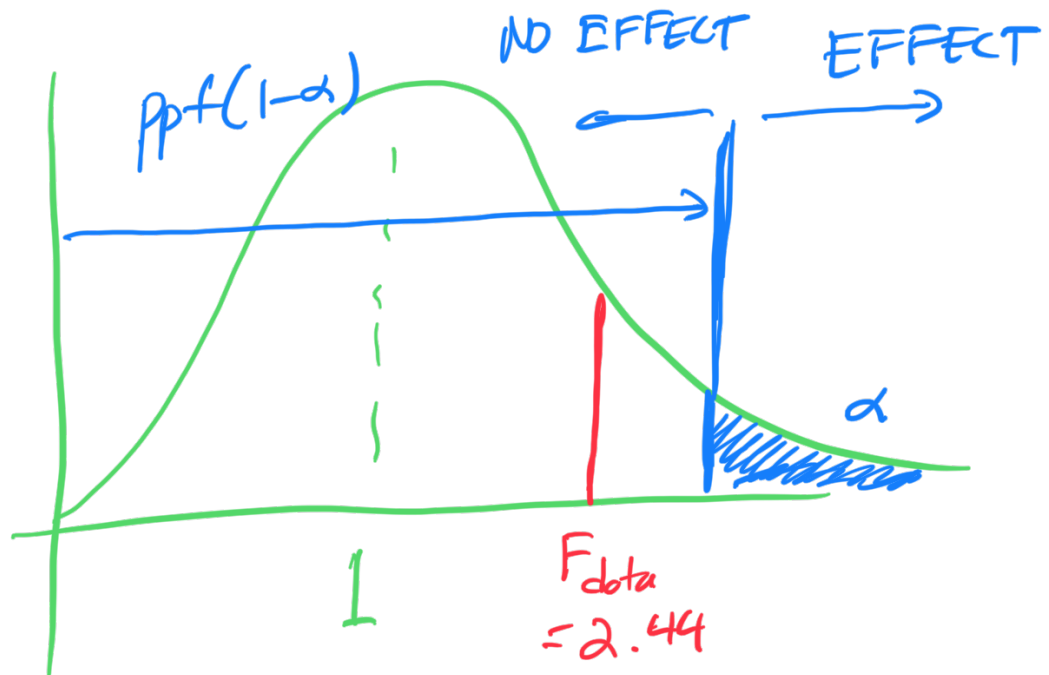
$$n = 3$$

$$N_{\text{dof}}^{\text{total}} = 12 - 1 = 11$$

$$N_{\text{dof}}^{\text{trt}} = a - 1 = 4 - 1 = 3$$

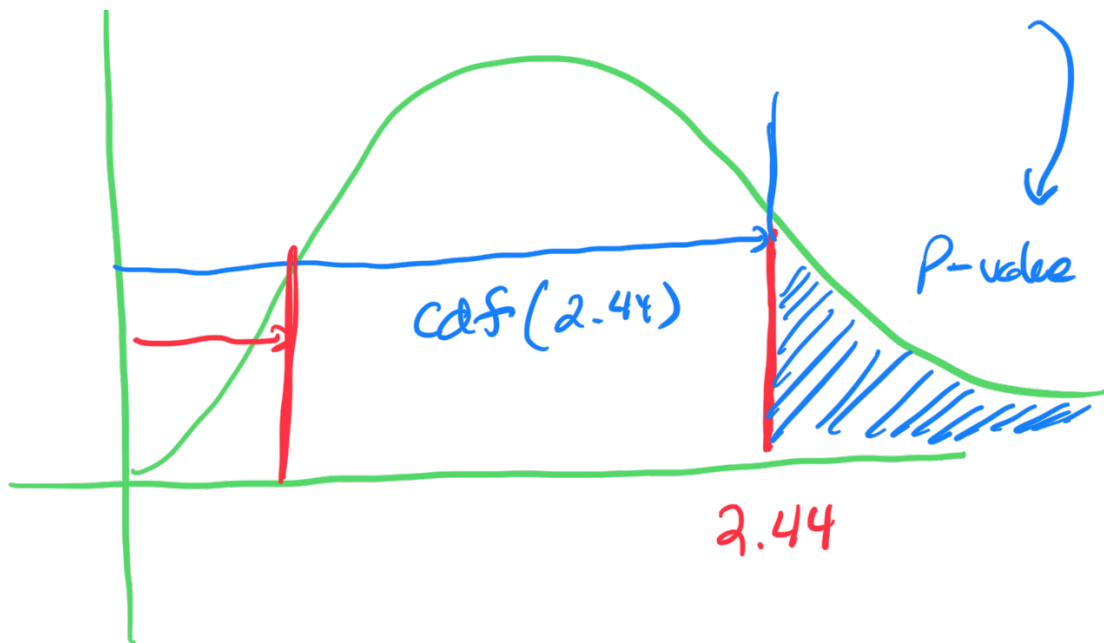
$$N_{\text{dof}}^{\text{err}} = 11 - 3 = 8$$

$$F_{\text{stat}} = \frac{MS_{\text{treatment}}}{MS_{\text{error}}}$$



Fail to reject null hypothesis!

$$1 - \text{cdf}(2.44)$$



Q2.

	1 A	2 B	3 C	4 D
1	—	—	—	—
2	—	—	—	—
3	—	—	—	—
4	—	—	—	—
5	—	—	—	—
6	—	—	—	—

$$a = 4$$

$$n = 6$$

$$N = 24$$

$$N_{\text{def}}^{\text{trt}} = \boxed{23}$$

$$N_{\text{def}}^{\text{trt.}} = 4 - 1 = \boxed{3}$$

$$N_{\text{dof}}^{\text{error}} = \underline{20}$$

(i) $\bar{x}_1, \bar{x}_2, \bar{x}_3, \bar{x}_4$

\bar{x}

$$SS_{\text{TRT}} = \sum_{i=1}^a n(\bar{x}_i - \bar{x})^2$$

$$SS_{\text{TOTAL}} = N_{\text{dof}}^{\text{tot}} * \text{var}(\quad)$$

$$SS_{\text{ERROR}} = SS_{\text{TOTAL}} - SS_{\text{TRT}}$$

f, f_{crit}

(ii) ANOVA package from stats model

Step 1 → make the data fit
the form that the package
wants.

Step 2 → use package.

Pandas

Data Frame.

Stats Model ANOVA

<u>Index</u>	<u>Value</u>	<u>Treatment Value</u>
0	655.5	1
1	788.3	1
2	.	1
3	.	2
4	.	2
5	.	2
.	.	2
.	.	2
.	.	2
.	.	.
.	.	.
.	.	.
.	.	4
.	.	4
.	.	4
.	.	4
23	630.0	4

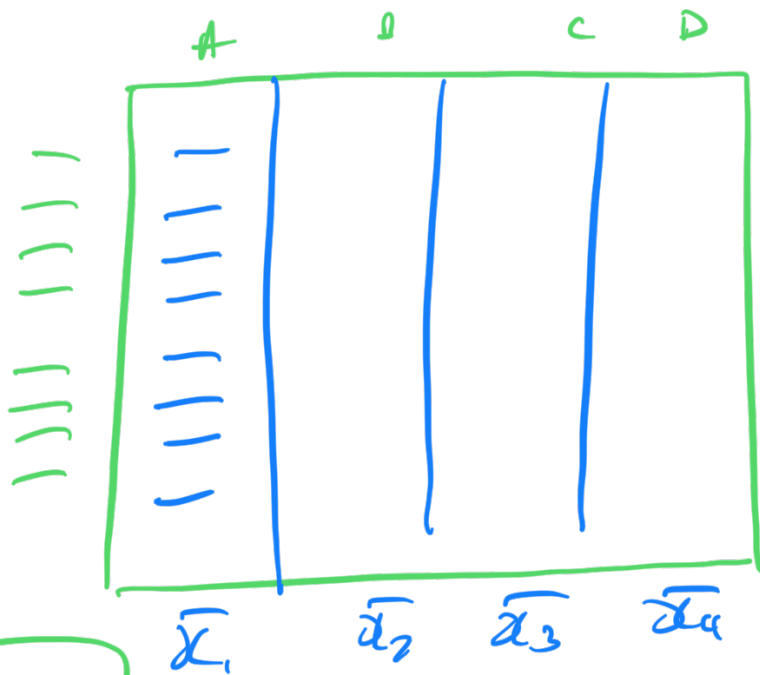
	A	B	C	D
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				

data = (.....)
 id = (.....)

Q3. $a = 3$
 $n = 9$

Q4 :

8



$a = 4$
 $n = 8$

| ————— |

$$x_{1.} \rightarrow \bar{x}_1$$

$$x_{2.} \rightarrow \bar{x}_2$$

$$x_{3.} \rightarrow \bar{x}_3$$

$$x_{4.} \rightarrow \bar{x}_4$$

$$x_{..} \rightarrow \bar{\bar{x}}$$

$$\sum \sum x_{ij}^2 \rightarrow \sum_{i=1}^a \sum_{j=1}^n x_{ij}^2$$

Sum of squares of each data pt.

$$(a-b)^2 = a^2 - 2ab + b^2$$

$$SS_{\text{TREATMENT}} = \sum_{i=1}^a (\bar{x}_i - \bar{\bar{x}})^2 \cdot n$$
