

ANOVA

CAFFEINE

We have three groups that do not consume caffeine (G1), consume a moderate amount of caffeine (G2) or consume a huge amount of caffeine (G3).

The parameter that we are analyzing is represented in the value on the next table.

Test Scores		
G1: Control	G2: Mild	G3: Jolt
75	80	70
77	82	72
79	84	74
81	86	76
83	88	78

Does caffeine affect this parameter? Develop the ANOVA by hand.

F	Numerator df: dfB				
Critical values					
dfW	1	2	3	4	5
5 5%	6.61	5.79	5.41	5.19	5.05
1%	16.3	13.3	12.1	11.4	11.0
10 5%	4.96	4.10	3.71	3.48	3.33
1%	10.0	7.56	6.55	5.99	5.64
12 5%	4.75	3.89	3.49	3.26	3.11
1%	9.33	6.94	5.95	5.41	5.06
14 5%	4.60	3.74	3.34	3.11	2.96
1%	8.86	6.51	5.56	5.04	4.70

$$F = \frac{SSB/(K-1)}{MSE}$$

$$MSE = \frac{1}{N-K} \sum_j \sum_i (x_{ij} - \bar{X}_j)^2$$

$$SSB = N_{4mm} (\bar{X}_{4mm} - \bar{\bar{X}})^2 + N_{6mm} (\bar{X}_{6mm} - \bar{\bar{X}})^2 + N_{8mm} (\bar{X}_{8mm} - \bar{\bar{X}})^2$$

EXAMPLE 2

Compare four different treatments to detect if there is any difference on the new approach.

$$F = \frac{SSB/(K-1)}{MSE}$$
 "F" distribution, with K-1 and N-K degrees of freedom

$$SSB = N_A \left(\bar{X}_A - \bar{\bar{X}}\right)^2 + N_B \left(\bar{X}_B - \bar{\bar{X}}\right)^2 + N_C \left(\bar{X}_C - \bar{\bar{X}}\right)^2 + N_D \left(\bar{X}_D - \bar{\bar{X}}\right)^2$$

$$MSE = \frac{1}{N-K} \sum_j \sum_i \left(x_{ij} - \bar{X}_j\right)^2$$

n	A	B	C	D
1	26,589	16,127	14,567	33,168
2	43,612	28,982	16,095	32,435
3	26,349	34,015	40,438	11,454
4	17,307	46,446	25,171	34,995
5	20,943	45,859	52,711	25,977

F table.

16	.100	3.05	2.67	2.46	2.33	2.24	2.18
	.050	4.49	3.63	3.24	3.01	2.85	2.74
	.025	6.12	4.69	4.08	3.73	3.50	3.34
	.010	8.53	6.23	5.29	4.77	4.44	4.20
	.001	16.12	10.97	9.01	7.94	7.27	6.80