ΑΝΑΛΥΣΗ ΔΙΑΚΥΜΑΝΣΗΣ

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https://cbom.atozmath.com/example/CONM/anova.aspx?he=e&q=anova2&ex=1

2. Solve using Two-way ANOVA method

Observation	A	B	C	D	E	F
1	1200	1000	980	900	750	800
2	1000	1100	700	800	500	700
3	890	650	1100	900	400	350

	A	*B*	*C*	*D*	*E*	*F*	Row total (x_r)
1	1200	1000	980	900	750	800	**5630**
2	1000	1100	700	800	500	700	**4800**
3	890	650	1100	900	400	350	**4290**
Col total (x_c)	**3090**	**2750**	**2780**	**2600**	**1650**	**1850**	**14720**

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$$\sum x^2 = 13010000 \rightarrow (A)$$

$$\frac{\sum x_c^2}{r} = \frac{1}{3}\left(3090^2 + 2750^2 + 2780^2 + 2600^2 + 1650^2 + 1850^2\right)$$

$$= \frac{1}{3}(9548100 + 7562500 + 7728400 + 6760000 + 2722500 + 3422500)$$

$$= \frac{1}{3}(37744000)$$

$$= 12581333.3333 \rightarrow (B)$$

$$\frac{\sum x_r^2}{c} = \frac{1}{6}\left(5630^2 + 4800^2 + 4290^2\right)$$

$$= \frac{1}{6}(31696900 + 23040000 + 18404100)$$

$$= \frac{1}{6}(73141000)$$

$$= 12190166.6667 \rightarrow (C)$$

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$$\frac{(\sum x)^2}{n} = \frac{(14720)^2}{18}$$

$$= \frac{216678400}{18}$$

$$= 12037688.8889 \rightarrow (D)$$

Sum of squares total

$$SS_T = \sum x^2 - \frac{(\sum x)^2}{n} = (A) - (D)$$

$$= 13010000 - 12037688.8889$$

$$= 972311.1111$$

Sum of squares between rows

$$SS_R = \frac{\sum x_r^2}{c} - \frac{(\sum x)^2}{n} = (C) - (D)$$

$$= 12190166.6667 - 12037688.8889$$

$$= 152477.7778$$

Sum of squares between columns

$$SS_C = \frac{\sum x_c^2}{r} - \frac{(\sum x)^2}{n} = (B) - (D)$$

$$= 12581333.3333 - 12037688.8889$$

$$= 543644.4444$$

Sum of squares Error (residual)

$$SS_E = SS_T - SS_R - SS_C$$

$$= 972311.1111 - 152477.7778 - 543644.4444$$

$$= 276188.8889$$

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ANOVA table

Source of Variation	Sums of Squares SS	Degrees of freedom DF	Mean Squares MS	F
Between rows	$SS_R = 152477.7778$	$r - 1 = 2$	$MS_R = \frac{152477.7778}{2} = 76238.8889$	$\frac{76238.8889}{27618.8889} = 2.7604$
Between columns	$SS_C = 543644.4444$	$c - 1 = 5$	$MS_C = \frac{543644.4444}{5} = 108728.8889$	$\frac{108728.8889}{27618.8889} = 3.9368$
Error (residual)	$SS_E = 276188.8889$	$(r - 1)(c - 1) = 10$	$MS_E = \frac{276188.8889}{10} = 27618.8889$	
Total	$SS_T = 972311.1111$	$rc - 1 = 17$		

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https://getcalc.com/statistics-anova-calculator.htm?inp1=8+7+5+5&inp2=7+4+4+8&inp3=3+4+5+6&option=2

http://archive.bio.ed.ac.uk/jdeacon/statistics/tress8.html