

ONE WAY ANOVA : WORKED EXAMPLE

- Scores from three samples A,B and C
- Sample Mean and Standard Deviations given for each sample.
- Also given is the overall sample mean and standard deviation (for all 12 items)

	A	B	C	Total
	15.08	22.58	10.67	
	13.58	19.33	13.42	
	12.33	22.42	13.92	
	12.08	22.92	10.67	
mean	13.2675	21.8125	12.17	15.75
std. deviation	1.375	1.66808	1.744037	4.729759

Individually compute the following identities

- Total Sum of Squares (TSS)
- Between-Groups Sum of Squares (SSB)
- Within Groups Sums of Squares (SSW)

Confirm the following equation

$$TSS = SSB + SSW$$

Complete the ANOVA Table

<u>Source</u>	<u>D.F.</u>	<u>S.S</u>	<u>MS</u>	<u>F</u>	<u>p-value</u>
Between Groups					
Within Groups					
Total					

P-Values for Various Test Statistics

Test Statistic	p-value
11.65	3.18E-03
20.34	4.58E-04
35.98	5.09E-05
43.34	2.36E-05
48.92	1.46E-05

One Way ANOVA - Worked Example

1. A trial is undertaken to investigate the effect on fuel economy of 3 fuel additives A, B and C, where A and B are new and C is the current standard additive. The same driver drives the same car on a fixed test route during 20 working days. The additive used on each day is randomly assigned so that A and B are each used for 5 days and C is used for 10 days. The response variable measured each day is Y , the number of miles per gallon (mpg) achieved.

The results are shown in the following table.

Additive	y	Total
A	39, 35, 37, 36, 38	$\sum y_A = 185$
B	36, 41, 39, 40, 39	$\sum y_B = 195$
C	37, 33, 30, 34, 36, 34, 31, 36, 34, 35	$\sum y_C = 340$

You are given that the sum of squares of the observations is 26078.

- (i) (a) Carry out an analysis of variance to test for differences between the effects on Y of the additives. State clearly your null and alternative hypotheses and present your conclusions. (11)

You are given the additional piece of information, sufficient to construct ANOVA table

	A	B	C	Total
mean	37	39	34	36
std. deviation	1.5811	1.8708	2.2111	2.8837

Solution to One Way ANOVA Table

- Additives: Between Groups
- Residuals : Within Groups

Hence the analysis of variance table is as follows.

SOURCE	DF	SS	MS	F value
Additives	2	90	45	11.25 Compare $F_{2,17}$
Residual	17	68	4	$= \hat{\sigma}^2$
TOTAL	19	158		