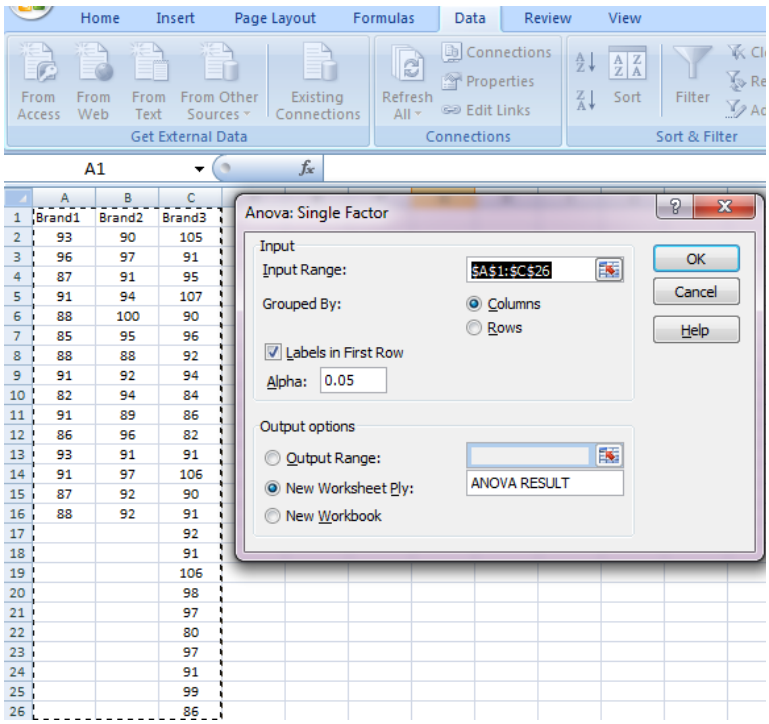
Example 1: One Way ANOVA in Excel

A consumer group wants to compare a new brand of wax (Brand-X) to two leading brands (Sureglow and Microsheen) in terms of Effectiveness of wax. Following data is collected for this purpose:

Brand	Effectiveness	Brand	Effectiveness	Brand	Effectiveness
Sureglow	93	Mirrorsheen	90	Brand_X	105
Sureglow	96	Mirrorsheen	97	Brand_X	91
Sureglow	87	Mirrorsheen	91	Brand_X	95
Sureglow	91	Mirrorsheen	94	Brand_X	107
Sureglow	88	Mirrorsheen	100	Brand_X	90
Sureglow	85	Mirrorsheen	95	Brand_X	96
Sureglow	88	Mirrorsheen	88	Brand_X	92
Sureglow	91	Mirrorsheen	92	Brand_X	94
Sureglow	82	Mirrorsheen	94	Brand_X	84
Sureglow	91	Mirrorsheen	89	Brand_X	86
Sureglow	86	Mirrorsheen	96	Brand_X	82
Sureglow	93	Mirrorsheen	91	Brand_X	91
Sureglow	91	Mirrorsheen	97	Brand_X	106
Sureglow	87	Mirrorsheen	92	Brand_X	90
Sureglow	88	Mirrorsheen	92	Brand_X	91
				Brand_X	92
				Brand_X	91
				Brand_X	106
				Brand_X	98
				Brand_X	97
				Brand_X	80
				Brand_X	97
				Brand_X	91
				Brand_X	99
				Brand_X	86

To run the One-Way ANOVA procedure in Excel, open the data file '1Way ANOVA in Excel.xlsx' , go to the worksheet 'Data in 3 Columns', click on Data/Data Analysis/ANOVA:Single Factor, select Input Range A1:C26, Grouped by Columns, check Labels in First Row Box. give a name to Output Worksheet (ANOVA RESULT, for example), and click on OK.



	A	B	C
1	Brand1	Brand2	Brand3
2	93	90	105
3	96	97	91
4	87	91	95
5	91	94	107
6	88	100	90
7	85	95	96
8	88	88	92
9	91	92	94
10	82	94	84
11	91	89	86
12	86	96	82
13	93	91	91
14	91	97	106
15	87	92	90
16	88	92	91
17			92
18			91
19			106
20			98
21			97
22			80
23			97
24			91
25			99
26			86

Figure 1a: Running 1-Way ANOVA in Excel

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Brand1	15	1337	89.13333	12.98095
Brand2	15	1398	93.2	11.17143
Brand3	25	2337	93.48	53.67667

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	197.0085	2	98.50424	3.149474	0.051157	3.175141
Within Groups	1626.373	52	31.27641			
Total	1823.382	54				

Figure 1b: Output of 1-Way ANOVA in Excel

Since the P-value is .051157 > .05, the null hypothesis of equal means is not rejected.

Example 2: Two Way ANOVA with Replications in EXCEL

Following table shows drying time of concrete obtained from a set of 12 experiments conducted at 3 levels of CONCRETE amounts, and 2 levels of WATER amounts (see worksheet CONCRETE DATA of file 2Way ANOVA in Excel.xlsx).

CONCRETE(CUPS)	WATER(CUPS)	TIME(MINUTES)
1.5	0.25	23
1.5	0.25	21
1.5	0.5	153
1.5	0.5	161
1.75	0.25	25
1.75	0.25	27
1.75	0.5	159
1.75	0.5	171
2	0.25	29
2	0.25	31
2	0.5	183
2	0.5	187

Test if the factors CONCRETE and WATER have an effect on mean drying time.

Most statistical software packages require the data in the following format:

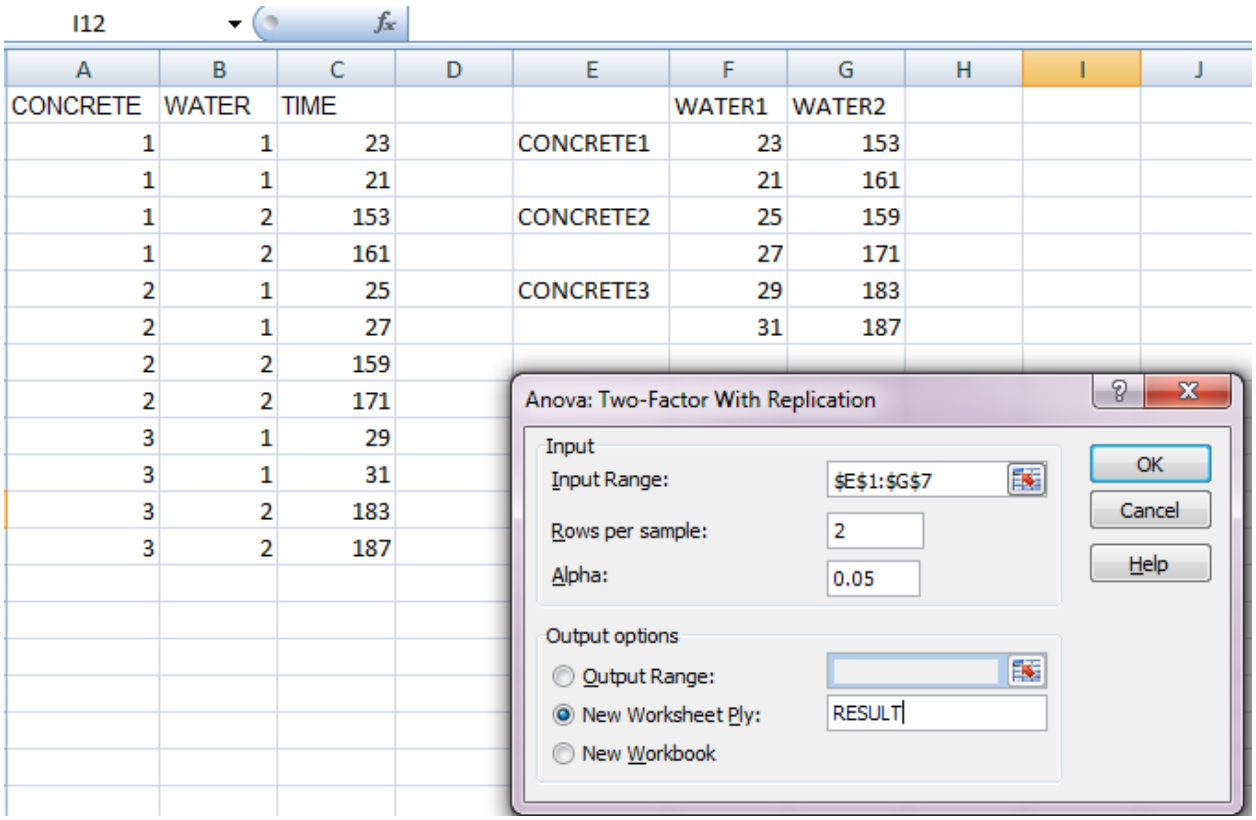
CONCRETE	WATER	TIME
1	1	23
1	1	21
1	2	153
1	2	161
2	1	25
2	1	27
2	2	159
2	2	171
3	1	29
3	1	31
3	2	183
3	2	187

Excel, however, needs data in a different format (see Example 2a).

In Example 2, there are 2 replicates for each treatment combination, so in Excel, click on

Data/Data Analysis/ANOVA:Two-Factor With Replication
Select E1:G7 as the Input Range

Type 2 in Rows Per Sample box
Give a name to New Worksheet Ply (RESULT used in this example), then click OK. The output is shown in Figure 2b.



I12

A	B	C	D	E	F	G	H	I	J
CONCRETE	WATER	TIME			WATER1	WATER2			
1	1	23		CONCRETE1	23	153			
1	1	21			21	161			
1	2	153		CONCRETE2	25	159			
1	2	161			27	171			
2	1	25		CONCRETE3	29	183			
2	1	27			31	187			
2	2	159							
2	2	171							
3	1	29							
3	1	31							
3	2	183							
3	2	187							

Figure 2a: Excel data format and running 2-way ANOVA with Replication in Excel

	A	B	C	D	E	F	G
1	Anova: Two-Factor With Replication						
2							
3	SUMMARY	WATER1	WATER2	Total			
4	*CONCRETE1*						
5	Count	2	2	4			
6	Sum	44	314	358			
7	Average	22	157	89.5			
8	Variance	2	32	6086.333			
9							
10	*CONCRETE2*						
11	Count	2	2	4			
12	Sum	52	330	382			
13	Average	26	165	95.5			
14	Variance	2	72	6465			
15							
16	*CONCRETE3*						
17	Count	2	2	4			
18	Sum	60	370	430			
19	Average	30	185	107.5			
20	Variance	2	8	8011.667			
21							
22	*Total*						
23	Count	6	6				
24	Sum	156	1014				
25	Average	26	169				
26	Variance	14	188.8				
27							
28							
29	ANOVA						
30	*Source of Variation*	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
31	Sample	672	2	336	17.08475	0.003332	5.143253
32	Columns	61347	1	61347	3119.339	2.21E-09	5.987378
33	Interaction	224	2	112	5.694915	0.041074	5.143253
34	Within	118	6	19.66667			
35							
36	Total	62361	11				

CONCRETE significant
WATER significant
INTERACTION significant

Figure 2b: Excel Output from 2-way ANOVA with Replication (see worksheet CONCRETE RESULT of file 2Way ANOVA in Excel.xlsx)

Example 3: Two Way ANOVA without Replication in EXCEL

An experiment is conducted to determine whether the brand of laundry detergent used and the water temperature affects the amount of dirt removed dirty laundry, and following data is collected (see worksheet LAUNDRY DATA of file 2Way ANOVA in Excel.xlsx).

	COLD	WARM	HOT
Brand A	4	8	10
Brand B	7	13	16

In this example, we only have 1 run per treatment combination, so you need to click on the sequence

Data/Data Analysis/ANOVA:Two-Factor Without Replication
Select B2:D3 as the Input Range (non-numeric data not allowed in this case)
Type output Worksheet Name (LAUNDRY RESULT) and click Ok
(see Figure 3a).

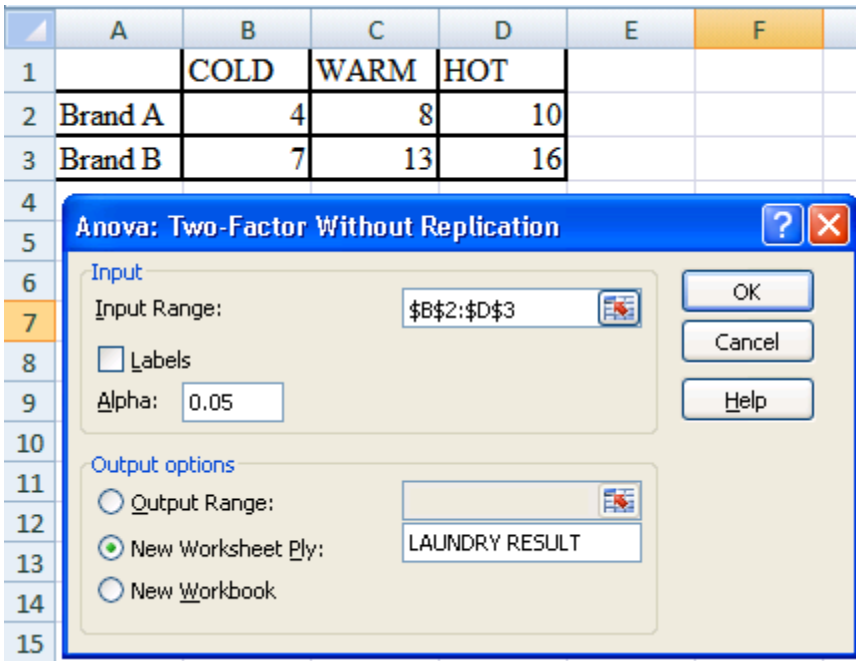


Figure 3a: Running 2-way ANOVA Without Replication in Excel

The output is shown in Figure 3b.

	A	B	C	D	E	F	G
1	Anova: Two-Factor Without Replication						
2							
3	*SUMMARY*	*Count*	*Sum*	*Average*	*Variance*		
4	Row 1	3	22	7.333333	9.333333		
5	Row 2	3	36	12	21		
6							
7	Column 1	2	11	5.5	4.5		
8	Column 2	2	21	10.5	12.5		
9	Column 3	2	26	13	18		
10							
11							
12	ANOVA						
13	*Source of Variation*	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
14	Rows	32.66667	1	32.66667	28	0.033908	18.51282
15	Columns	58.33333	2	29.16667	25	0.038462	19
16	Error	2.333333	2	1.166667			
17							
18	Total	93.33333	5				

BRAND significant
TEMPERATURE significant

Figure 3b: Output of 2-way ANOVA Without Replication in Excel (see worksheet LAUNDRY OUTPUT of file 2Way ANOVA in Excel.xlsx)

Note that there is no interaction term in this case.