

Instructions for carrying out statistical procedures and tests using Minitab

These instructions are closely linked to the author's book:

Essential Statistics for the Pharmaceutical Sciences
John Wiley & Sons Ltd <http://eu.wiley.com>
2007
ISBN: 978-0-470-03468-2

For all references to chapters or tables, see the above book.

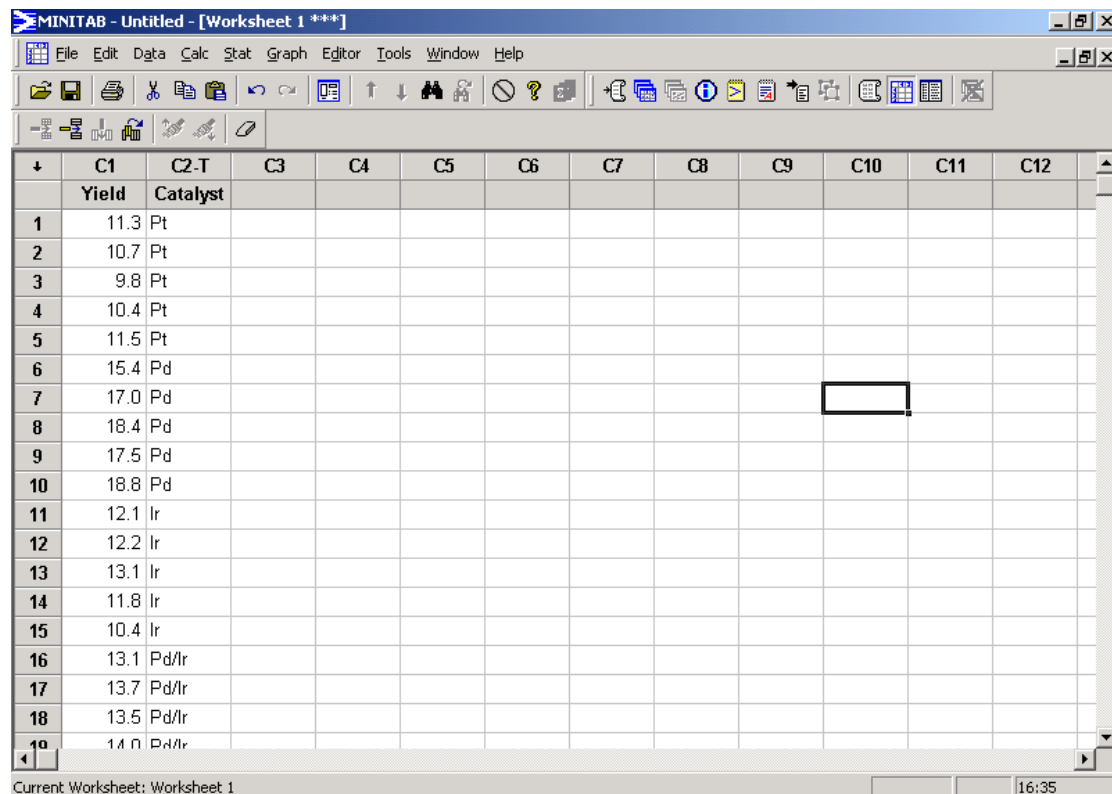
**Using Minitab to perform a
one-way analysis of variance**

Using Minitab to perform a one-way analysis of variance

Example: Table 13.1 Effect of catalyst on yield (Percentage of theoretical maximum)

Label one column to hold the yields ('Yield') and another to hold the labels that will indicate which group each yield belongs to.

Enter all the percentage yields into the relevant column and put suitable labels into the other column. The worksheet should then look like this:



The screenshot shows a Minitab worksheet titled 'MINITAB - Untitled - [Worksheet 1 ***]'. The menu bar includes File, Edit, Data, Calc, Stat, Graph, Editor, Tools, Window, and Help. The toolbar contains various icons for file operations, editing, and analysis. The worksheet grid has 13 columns labeled C1 through C12. Column C1 is labeled 'Yield' and column C2 is labeled 'Catalyst'. The data is as follows:

	C1	C2-T	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
	Yield	Catalyst										
1	11.3	Pt										
2	10.7	Pt										
3	9.8	Pt										
4	10.4	Pt										
5	11.5	Pt										
6	15.4	Pd										
7	17.0	Pd										
8	18.4	Pd										
9	17.5	Pd										
10	18.8	Pd										
11	12.1	Ir										
12	12.2	Ir										
13	13.1	Ir										
14	11.8	Ir										
15	10.4	Ir										
16	13.1	Pd/Ir										
17	13.7	Pd/Ir										
18	13.5	Pd/Ir										
19	14.0	Pd/Ir										

Follow the menus Stat / ANNOVA / One way

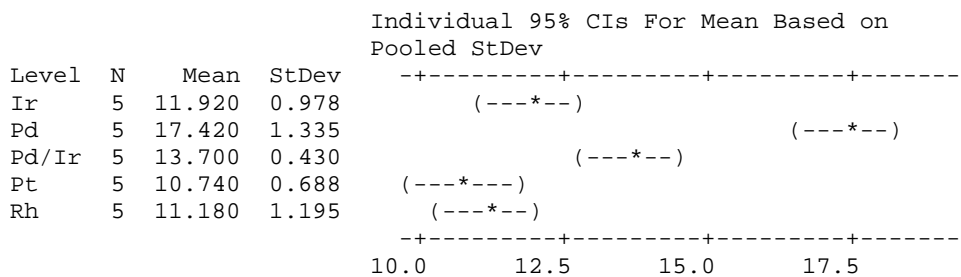
In the box labelled 'Response:', enter the name of the column containing the data to be analysed ('Yield'). In the box labelled 'Factor:', enter the name of the column containing the labels for the groups ('Catalyst').

The output will be as on next page:

One-way ANOVA: Yield versus Catalyst

Source	DF	SS	MS	F	P
Catalyst	4	148.062	37.016	38.37	0.000
Error	20	19.296	0.965		
Total	24	167.358			

S = 0.9822 R-Sq = 88.47% R-Sq(adj) = 86.16%



Pooled StDev = 0.982

The P value is reported as 0.000 (Which should be reported as '<0.001') and is clearly significant. This means that at least one of the catalysts differs from one of the others. The problem is deciding which differs from which.

The diagrammatic material towards the end of the output, gives a visual impression, but can never be definitive. Palladium is pretty clearly superior to all others but among the remainder, the situation is unclear. For a definitive analysis, you will need to add on either a [Tukey's](#) or a [Dunnnett's](#) test.