

# QUEEN MARY, UNIVERSITY OF LONDON

**MAS 314**

**Design of Experiments**

**Practical 1**

**10–15 January 2007**

**1 (Getting Started)** This practical reminds you about the statistical computing language **Genstat**. The work is on the PC network. I assume that you know how to log onto the PC network and how to print files from it.

When you log on you should select the environment

DOE Design of Experiments

Mathematics Department

The first time that you use **Genstat** for *MAS314 Design of Experiments* you should create a new directory (also called *folder*) in your own space called **DOE**. Remember to store all your files and results from this course in **DOE**.

Now you can start **Genstat**:

```
dept >> GenStat 7.2 ▷ GenStat
```

**2 (Data input by spreadsheet)** You can use **Genstat**'s spreadsheet facilities to read in the following data from the keyboard. Start the session by selecting **Blank Spreadsheet** and then clicking on **OK**.

area (cm <sup>2</sup> )	length (cm)	breadth (cm)
110.0	10.7	12.8
108.6	10.9	12.4
72.8	8.5	10.7
85.2	9.4	11.2
80.5	9.0	10.9
95.0	10.2	11.8
96.8	10.5	11.5
80.9	9.0	11.0
97.3	10.1	12.0
108.0	11.2	12.2
69.0	8.1	10.8
110.0	10.8	12.9

In the **Dialogue Box** type or choose

**Rows:**   
**Columns:**   
 **Set as Active Sheet**

Click on **OK** and then type in the data.

Now edit the column attributes.

Spread → Column → Attributes/Format

In the **Dialogue Box** choose/type

**Column:**   
**Name:**   
**Description:**   
**Decimals:**   
**Width:**

Choose the *default* justification and the *fixed* numeric format. Then click on **Apply**.

Similarly, give attributes to columns C2 and C3. When you are satisfied with the outcome, click on **OK**.

**3 (Saving and viewing data)** Save these data in a file as follows. While the spreadsheet window is highlighted,

File → Save

Save it in your DOE folder under a name of your choice.

To get the data into the **Output Window**, ask Genstat to print the data to it. Click on the icon below File to obtain an **Input Window**. Type the following in the **Input Window**:

PRINT area, length, breadth The first word here is the Genstat command. It can be in upper or lower case. The other words are the variates. Does it matter whether they are in upper or lower case?

Run the command by doing

Run → Submit Line

Now look at everything in the **Output Window**. Make sure that you understand every line of output.

If you have lost the **Input Window**, you should be able to get it back by

Window → Input Window;1

**4 (Calculation)** There are two ways of performing calculations on variates. Here we give the example of finding the product of length and breadth.

**Method 1** Type the following two lines in the **Input Window** and submit them.

```
calculate X1 = length * breadth  
print length, breadth, X1
```

**Method 2** Use the mouse.

Data → Calculations...

In the **Dialogue Box** either type length \* breadth in the first field, or achieve the same thing by choosing the variates from the **Available Data** and the operator \* from the table provided. Also type

**Save Result in:**

Tick the box to print the result in the **Output Window**, and the one to display it in the spreadsheet, remembering to choose the original spreadsheet. Click on **OK**.

In the rest of this practical, X denotes either X1 or X2, depending on which method you have used for the calculation.

**5 (Simple graph)** We expect that area should be proportional to X. To plot a graph of area against X, proceed as follows.

Graphics → Point Plot

In the **Dialogue Box**, use the **Available Data** to choose

**Select Y:**   
**Select X:**

Click on **Next**, type in a title of your choice and then click on **Finish**.

You might like to experiment with the tools available to view the graph on screen. You should be able to move it around and to change its size.

If you have time, you might also like to experiment with other features available when you draw the graph, such as names for the axes, type of plotting symbol, and so on.

**6 (Regression)** We are going to fit a model of the form

$$E(\text{area}) = a + bX.$$

From your graph, can you guess suitable values of  $a$  and  $b$ ?

Genstat can fit the model as follows.

Stats → Regression Analysis → Linear Models...

In the **Dialogue Box** choose/type

<b>Response Variate</b>	Simple Linear Regression
<b>Explanatory Variate</b>	area
	X

Fill in the estimated values:

$\hat{a} =$   
 $\hat{b} =$

Also complete the ANOVA table.

Source	df	SS	MS	VR

From the anova table, estimate  $\sigma^2$ .

**7 (Finishing the session)** Select

File → Exit

Remember to log out.