620-270  Applied Statistics

Computer Lab 1

In this lab session you will

- become familiar with MINITAB Release 13 for PC.
- learn how to use menus and commands.
- use MINITAB to reinforce material covered in the lectures.

1. Starting up

Start Virtual PC, via the Applications folder on the Mac.
Start MINITAB.
Later on it will be necessary to print out some MINITAB output to be included in your assignments.

2. Entering and describing data

The following data are the number of infected leaves (out of 100) from plots in a tomato experiment:

53 52 37 46 32 57 33 35 44 54 59 39 46 30 67 39 37 44 32

Enter the data into C1.
Obtain summary statistics using the menu
Stat → Basic Statistics → Display Descriptive Statistics.
Notice that this generates the command DESCRIPTIVE C1. Click on the Session Window and type this command. The output should be the same. Note that MINITAB commands can be abbreviated to 4 letters or more.

3. Stacking and unstacking

Four chemical treatments (A, B, C, D) were each applied to six plots in the same tomato experiment. The following numbers of tomatoes were produced per plot:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>147</td>
<td>168</td>
<td>124</td>
<td>178</td>
</tr>
<tr>
<td>192</td>
<td>204</td>
<td>161</td>
<td>179</td>
</tr>
<tr>
<td>158</td>
<td>208</td>
<td>130</td>
<td>141</td>
</tr>
<tr>
<td>140</td>
<td>143</td>
<td>183</td>
<td>155</td>
</tr>
<tr>
<td>148</td>
<td>160</td>
<td>163</td>
<td>139</td>
</tr>
<tr>
<td>130</td>
<td>134</td>
<td>156</td>
<td>179</td>
</tr>
</tbody>
</table>

Enter the data into C1-C4 and name the columns A, B, C and D.
Stack the data into column C5 and put the indicators (subscripts) in C6, using the commands

MTB > stack c1-c4 c5;
SUBC > subs in c6.

Now delete the data in C5 and C6, and perform the same stacking through the menu by
Manip → Stack → Stack Columns.
4. **Saving and retrieving**

Save the data into the Student Folder on the Desktop using the menu **File → Save Current Worksheet**.

If you wanted to keep the old version as well, you would use **File → Save Current Worksheet As**.

Quit Minitab. While you are in the Desktop, open the Student Folder where you saved the worksheets, and you should see your file, named `filename.MTW`.

Retrieve the data by either

- starting Minitab and using **File → Open Worksheet** or
- from the Student Folder, double clicking on the worksheet. This will launch Minitab as well as the worksheet.

To save your output in addition to the worksheet, you can save it all as a "Minitab project", by **File → Save Project**.

The project, which contains all the output from the session as well as the data, can be retrieved by **File → Open Project**.

The project is stored as `filename.MPJ`.

Try saving and retrieving your work as a project.

5. **Finding probabilities**

The command **CDF** evaluates the cdf of a range of distributions. It evaluates the cdf for the distribution specified by the subcommand. (If no distribution is specified the standard normal distribution is assumed.) For example:

```
MTB > cdf 2.1;
SUBC > normal 3, 4.
```

```
MTB > cdf 2.1;
SUBC > t 9.
```

```
MTB > cdf 2.1;
SUBC > chisquare 4.
```

Try out what each of these commands and see what they do.

cdfs can also be found using the menus. For example, to find the above probability for the normal distribution, go

**Calc → Probability Distributions → Normal**

and fill in the mean (3), the standard deviation (4), the "input constant" (2.1), and tick on **Cumulative probability**.

The CDF command also works with a column as an argument instead of just a number. If C5 contains the numbers 1, 2, 3, 4 and 5, the command **CDF C5** will give the cdf for `x = 1, 2, 3, 4, 5`.

Type in a series of numbers into a column, and try this using the command **CDF**, and then using the menu.

Note that the window created when you last used the menu can be retrieved by clicking on the **Edit Last Dialog** icon on the toolbar (8th icon from the left).
Compute the following probabilities:

(a) \( \Pr(X < 62.3) \) where \( X \sim N(\mu = 50.1, \sigma = 8.4) \)
(b) \( \Pr(X > 20) \) where \( X \sim N(\mu = 23, \sigma = 5.5) \)
(c) \( \Pr(40 \leq X \leq 60) \) where \( X \sim N(\mu = 65, \sigma = 12) \)

Check the first one using tables.

6. Finding quantiles

The command \texttt{INVCDF} evaluates the inverse cdf, i.e., the quantiles. To specify the distribution, we use the subcommand \texttt{Norm}:

\texttt{MTB > INVCDF 0.6; SUBC> NORMAL 10 4.}

This evaluates the 0.6-quantile of \( N(\mu = 10, \sigma = 4) \), i.e., it gives \( c_{0.6} = F_{X}^{-1}(0.6) \).

Note that \texttt{MINITAB} uses \( \sigma \) and not \( \sigma^2 \).

The command \texttt{INVCDF} operates similarly to the command \texttt{CDF}, and for the same range of distributions.

Inverse cdfs can also be found using the menus. For example, to find quantiles for the normal distribution, go

Calc \rightarrow Probability Distributions \rightarrow Normal

and this time tick on Inverse cumulative probability.

Compute the following:

(a) Find the quartiles of \( X \sim N(\mu = 50, \sigma = 10) \).
(b) Find the 0.01 quantile of \( Y \sim t_{16} \).
(c) Find the 0.95 quantile of \( Z \sim \chi^2_{n} \) for \( n = 10, 20, 30, 40 \)
   and check the value for \( n = 10 \) given in the tables.

The \texttt{INVCDF} command (or the menu equivalent) also works with a column as an argument instead of just a number. For instance \texttt{INVCDF C11 C12} evaluates the inverse cdf for each of the values in \texttt{C11} (provided they are between 0 and 1) and puts the results into \texttt{C12}.

Thus the quartiles of \( N(\mu = 50, \sigma = 10) \) are given by the following \texttt{MINITAB} commands:

\texttt{MTB > SET C1}
\texttt{DATA> 0.25 0.50 0.75}
\texttt{DATA> INVCDF C1 C2; SUBC> NORMAL 50 10.}

Find the deciles of \( Y \sim N(\mu = 50, \sigma = 10) \).

7. Saving, Printing and Finishing

Save work in the Student Folder, which is shared by Virtual PC and the Mac. This work is only saved on the machine you are using, and may be deleted by other students and staff. Copying work to your own disk, and printing, will be considered in future sessions. On the Virtual PC there is a file called Opening and Saving Files. If you have time, have a look at this. On the Mac there is a file in the Applications folder called How to Save/Print Files.

When you have finished, close \texttt{MINITAB}.

Shut down Windows.