Homework Solutions for Lesson 1

In this assignment we will generate some simple statistics in an exploratory data analysis (EDA) by hand and with SAS, and produce a means (or interval) plot using Minitab.

In the hypothetical greenhouse example there were six pots that were assigned (at random) to receive a fertilizer treatment. Each of these pots represents an *experimental unit*, which by definition is that which receives a treatment. The response variable is plant height (cm). The data is presented below in ‘unstacked’ format, a very common way that we encounter experimental data.

|  |  |  |  |
| --- | --- | --- | --- |
| F1 | F2 | F3 | Control |
| 32 | 22.5 | 28 | 21 |
| 30.5 | 26 | 27.5 | 19.5 |
| 25 | 28 | 31 | 22.5 |
| 27.5 | 27 | 29.5 | 21.5 |
| 28 | 26.5 | 30 | 20.5 |
| 28.6 | 25.2 | 29.2 | 21 |
|  |  |  |  |

\*\*\* **Note that we are not asking for an ANOVA in this assignment**. \*\*\*

1) Compute the overall, or grand mean, of all observations (N=24), disregarding treatment levels. This can be done by hand, using a calculator, or using Excel. (10 pts)

2) Compute the mean for each treatment level. (20 pts)

3) Compute the variance, standard deviation, and sample standard error for each treatment level. (20 pts)

4) Open SAS and use the code provided in this lesson (see SAS code for Lesson 1.docx) to run the Summary procedure to produce the means and standard errors for the treatment levels. The SAS code can be cut and pasted from the Word document into the Program Editor Window in SAS and simply run without modification. Note that the data is re-formatted in the SAS code – this is the ‘stacked’ format. You can extract the output entitled Summary Output for Lesson 1 from the Output Window, and then paste it into your HW1 document. (30 pts)

5) Make an interval plot using Minitab or a Bar chart using Excel. The bar chart or interval plot will be similar to the ones shown in the Lesson 1 Notes, except that a) the plot shown in the Lesson 1 notes was produced by SAS following the ANOVA, and b) you won’t be labelling the means with lettering (a, ab, b, c) from the mean comparison procedure. You should include this graph in your submission. (20 pts)

What to turn in for the Homework Assignment Drop Box: Please use the Drop Box provided in this Lesson to submit ONE document (preferably a Word document, but a pdf file or scan will also work).

Solutions (Excel)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | F1 | F2 | F3 | Control |  | Trt | Height | (Yij-Yi.)^2 |  |  |  |  |
|  | 32 | 22.5 | 28 | 21 |  | F1 | 32 | 11.56 |  |  |  |  |
|  | 30.5 | 26 | 27.5 | 19.5 |  | F1 | 30.5 | 3.61 |  |  |  |  |
|  | 25 | 28 | 31 | 22.5 |  | F1 | 25 | 12.96 |  |  |  |  |
|  | 27.5 | 27 | 29.5 | 21.5 |  | F1 | 27.5 | 1.21 | **Treatment statistics** | | |  |
|  | 28 | 26.5 | 30 | 20.5 |  | F1 | 28 | 0.36 | s^2 | s | se |  |
|  | 28.6 | 25.2 | 29.2 | 21 |  | F1 | 28.6 | 0.00 | 5.94 | 2.4372 | 0.99499 |  |
|  |  |  |  |  |  | F2 | 22.5 | 11.33 |  |  |  |  |
| **grandmean** | 26.167 |  |  |  |  | F2 | 26 | 0.02 |  |  |  |  |
| **trtmeans** | 28.6 | 25.87 | 29.2 | 21 |  | F2 | 28 | 4.55 |  |  |  |  |
|  |  |  |  |  |  | F2 | 27 | 1.28 |  |  |  |  |
|  |  |  |  |  |  | F2 | 26.5 | 0.40 |  |  |  |  |
|  |  |  |  |  |  | F2 | 25.2 | 0.44 | 3.6067 | 1.8991 | 0.77531 |  |
|  |  |  |  |  |  | F3 | 28 | 1.44 |  |  |  |  |
|  |  |  |  |  |  | F3 | 27.5 | 2.89 |  |  |  |  |
|  |  |  |  |  |  | F3 | 31 | 3.24 |  |  |  |  |
|  |  |  |  |  |  | F3 | 29.5 | 0.09 |  |  |  |  |
|  |  |  |  |  |  | F3 | 30 | 0.64 |  |  |  |  |
|  |  |  |  |  |  | F3 | 29.2 | 0.00 | 1.66 | 1.2884 | 0.52599 |  |
|  |  |  |  |  |  | Control | 21 | 0.00 |  |  |  |  |
|  |  |  |  |  |  | Control | 19.5 | 2.25 |  |  |  |  |
|  |  |  |  |  |  | Control | 22.5 | 2.25 |  |  |  |  |
|  |  |  |  |  |  | Control | 21.5 | 0.25 |  |  |  |  |
|  |  |  |  |  |  | Control | 20.5 | 0.25 |  |  |  |  |
|  |  |  |  |  |  | Control | 21 | 0.00 | 1 | 1 | 0.40825 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| **SAS output** |  |  |  |  |  |  |  |  |  |  |  |  |
| Fert | \_TYPE\_ | \_FREQ\_ | mean | se | |  | | --- | |  | |  |  |  |  |  |  |  |
|  | 0 | 24 | 26.167 | 0.75238 |  |  |  |  |  |  |  |  |
| Control | 1 | 6 | 21 | 0.40825 |  |  |  |  |  |  |  |  |
| F1 | 1 | 6 | 28.6 | 0.99499 |  |  |  |  |  |  |  |  |
| F2 | 1 | 6 | 25.867 | 0.77531 |  |  |  |  |  |  |  |  |
| F3 | 1 | 6 | 29.2 | 0.52599 |  |  |  |  |  |  |  |  |
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