

## Review of Completely Randomized Designs

Respond to the following questions, and be sure to answer the questions fully, including any reactions or critiques you may have to the data or methodology.

The cow diet data from your book lists food intake (`dmi`) for 6 different diets.

Diet	Food Intake
1	27.81,27.76,21.48,24.72,26.23,23.95,24.37,26.20,24.25,28.18
2	26.49,22.66,27.54,28.01,23.36,24.61,28.01,26.95,28.02,23.71
3	27.66,27.10,25.12,25.18,32.95,24.86,24.99,23.69,26.65,18.97
4	24.49,25.41,25.18,27.13,24.92,22.96,24.96,26.69,22.98,21.67
5	26.75,17.09,23.75,23.03,24.24,25.18,27.89,25.34
6	26.04,23.95,22.92,27.49,23.81,22.34,27.30,25.47,23.39,26.35

Use the SAS source code and data set provided to generate output. Answer the following questions.

1. Based on the plot of diet vs. food intake, what would you say was the relationship between these two variables?
2. Does mean food intake depend on diet? Write this as a statistical hypothesis test and record the F-test and p-value from your handout.
3. Two different multiple comparison tests (Tukey's studentized range and Bonferroni's method) were conducted—do the results from these tests agree? Which one would you prefer in this case? Summarize your findings from this test.
4. Based on the residual plot, does the variation in food intake seem to be equal regardless of diet?

### Notes on using SAS

If you are not familiar with SAS, here are the steps needed to run the code provided on the home page using SAS for Windows, along with alternative methods for inputting data. In a separate section, I provide some notes on using SAS Studio.

For a first version of running the program, you should go to the course home page and save both the SAS source code (save it either as a text file or under "All Files" and rename it `diet.sas`) and data set (save it as a text file and name it `diet.txt`) as text files in your course folder. I will assume that you have created a subdirectory called `stat706` on, e.g., your W drive and that is where the files are stored. Some students find it convenient to open Notepad or Wordpad, and simply copy and paste the text from the webpage directly into a Notepad/Wordpad document, which they then save.

Right click on the source code file and select "Open in SAS 9.4" (if you double-click, the program may be opened in SAS Enterprise Guide instead, which I know some of you work with). The program should be loaded into a program editor window in SAS (changes can be

made to the source code at this point, if needed). If this does not work, double click on the SAS icon, select Menu in the Program Editor window, then select File and open diet.sas. Now click the Submit button under the Tools menu (or click F4, or click the running man symbol, or ...), and output will appear in the Results Viewer window, as well as being available in the Results tab in the left-hand frame. The output can then be printed, saved, or cut-and-pasted into other documents; many of the graphics documents will appear as .png image files in your directory; either use them or discard them as needed. If the program fails to run, the Log window will contain error messages, though they can be cryptic to beginning users. Again, students often find it easier to open the Program Editor in SAS, then copy and paste the source code into the Program Editor window, then save it as a SAS file.

There is an alternate form of data entry to the PROC IMPORT step which uses an Import Wizard to create the statements in the PROC IMPORT step, with a couple embellishments. Many students find the import wizard easier to use at first, but soon adopt the simplified PROC IMPORT step explained above. The Import Wizard is used most frequently when your data file has been saved in Excel, but can be used with text files if the data has been carefully formatted. In this case, we assume that the file diet.txt has been saved as tab-delimited text, with variable names appearing in the first row.

Click on the SAS icon on the desktop, and then select Import Data from the File menu. The file type Microsoft Excel Workbook will be selected by default; you should select Tab Delimited File (\*.txt) instead. In the Next window, browse to find the text file (most likely saved as diet.txt). In the Next window, you name the SAS library—we will use the default library WORK and name our file Diet. Press Finish and SAS should display a message saying the file WORK.DIET has been successfully created. You can select Libraries in the Explorer window, select Work, and then click on Diet to see the file.

At this point, you can reload diet.sas into the Program Editor, remove the PROC IMPORT statements and then run the program.

## **SAS Studio**

If you are using SAS Studio through SAS OnDemand, you need to use a completely different method for managing files; the user interface is different as well. On the other hand, using the SAS program window is similar to the way in which it is used in SAS for Windows.

Download `diet.sas` and `diet.txt` from the website into files with the same names in a course folder that you have created (make sure a file extension hasn't been added to the name). In SAS Studio, select the new file icon (a page with a star in the upper-right corner) in the left-hand frame under the Server Files and Folders tab and select SAS program. A frame labeled Program 1 will appear on the right with tabs for CODE, LOG and RESULTS. Open `diet.sas` in Notepad or Wordpad (not SAS), then copy-and-paste the contents of diet.sas into the CODE window. Click the Save or Save As icons to save the program as diet.sas.

We now need to upload the data set, `diet.txt`. Select Server Files and Folders and choose the Upload icon (an upward-pointing arrow). The dialog window lists a default directory (`\home1\your_user_name`); browse to select your saved version of diet.txt and upload it to the default directory, or create a course subdirectory and upload it to that subdirectory. Note that the file system is not your local directory, but an online directory exclusive to SAS OnDemand; this is one of the biggest differences between SAS OnDemand and SAS

Display Manager. Any program or data files you need to use in SAS OnDemand must first be uploaded to your file system.

Change the datafile option in the PROC IMPORT statement before proceeding. I used `DATAFILE="/home/grego1/STAT 706/diet.txt"`, for example. And in this particular case, I have saved `diet.txt` to the course directory in SAS OnDemand, so you could also use the file path I provided in Blackboard if you choose not to use your personal directory. Click the *Running Man* to execute the program. Several things should happen, including output in the RESULTS and LOG windows and addition of an OUTPUT DATA tab; the same data in the OUTPUT DATA tab will also be saved as a new SAS data set in the WORK library.

To see the SAS data set, click the Libraries tab in the left-hand frame. Then select My Libraries-Work. There should be a SAS data set named `diet`; click on that to open it as a worksheet. Confirm that the worksheet contains six variables, and then click on the name of each of the variables in the left-hand frame named **Columns** to see how SAS input each variable; their properties will be highlighted in the frame below. Close the Worksheet (leaving worksheets open sometimes will cause SAS to abort a run).

Click on the Results tab for output; expand Table of Contents to see how the output has been arranged as a series of HTML objects. Look in the LOG window. The messages here can be cryptic and a single mistake can create a cascade of red-highlighted code, which likely represent the consequence of the first error, not errors in and of themselves. I like to use it to check that all my intermediate data sets have actually been created; one way to detect such errors is to find that your data sets have 0 records. The Results tab in the left-hand frame can be used to display output from this window as well. If you expand the tabs fully, you'll see that each output has a pair of formats—an HTML version and an appropriate graphics or table version.

Note that you can upload `diet.sas` in the same way you uploaded `diet.txt`. After uploading it, right-click on `diet.sas` under Server Files and Folders, and select Properties; note the Unix-style directory reference for the file location. Double-click on `agency.sas` and a new tab for this program will open in the right-hand frame. Run the program after changing the DATAFILE option, then let's look at saving output.

As mentioned earlier, the Table of Contents under the Results tab contains the output in digest form. You can select a folder, expand it, then select Open in New Browser Window (the icon with an arrow pointing to the upper right), though this reproduces the entire display in Results, so it is not as selective as you would like. You can save the entire contents of the Results window by selecting one of three icons to Download results as an HTML file, PDF file or RTF file, respectively.

Individual objects can then be selected and copied into other documents. You can also click-and-drag to highlight a table (but not a graph)—don't worry if you pick up a couple leading/trailing blanks) and paste a table from this window in a Word document. Try it for a couple objects.

As one additional alternative, the Diet data set is one of Brian Yandell's data sets, and hence is available on the course's cloud directly. You can replace the first two PROC steps with the following to directly access the data set