Appendix E

GLSD can be used to generate values for the t (T), z (Z), Chi-square (X) and F (F) distributions (please see Figure 2, and options below. The different options are generated by typing the command "glsd" with the -h option to obtain a list of options supported by the program. Notice that the symbol ">" denotes the prompt and it corresponds to Linux, Mac OS or DOS terminal (Line command) in Windows (e.g., http://www.dosbox.com/ or http://www.freedos.org/)

```
> glsd -h

Options:
        -h              prints this text
        -lsd    compute lsd
        -F              output values of the Fisher-Snedecor distribution
        -T              output values of Student's distribution
        -X              output values of the Chi Square distribution
        -Z              output values of the normal distribution
        -cF             output critical values of the Fisher-Snedecor distribution
        -cT             output critical values of Student's distribution
        -cX     output critical values of the Chi Square distribution
        -cZ             output critical values of the normal distribution
        -tF             table of values of the Fisher-Snedecor distribution
        -tT             table of values of Student's distribution
        -tX             table of values of the Chi Square distribution
        -tZ             table of values of the normal distribution
        -tcF    table of critical values of the Fisher-Snedecor distribution
        -tcT    table of critical values of Student's distribution
        -tcX    table of critical values of the Chi Square distribution
        -tcZ    table of critical values of the normal distribution
        q               quit - ends the program
```

Once the program is running, one can obtain this list from the prompt

```
Enter Method (-h for help):
```

by entering the "-h" command. observe that the option "q", is used to quit the program.

This is basically how the program works. To simply compute the LSD, type

```
>glsd

One or two tailed test : 1      <------- Type 1 if you are conducting a one tailed test or 2 if you are conducting a two-tailed test.
Enter df value         : 23     <------- Enter the Degrees of Freedom. This corresponds to the df of the within group from the ANOVA table.
Enter P  value         : .05    <------- Enter the probability value or alpha (.01 or .05).
Enter MSE value        : 123    <------- Enter the within group estimate of the population variance (MSE) from the ANOVA TABLE (F=B/W), where W is the MSE Estimate of the within group estimate.
Enter N per group      : 20     <------- Enter the number of cases/observations per group. If you have three groups, each with 20 subjects, your n per group will be 20. If you have unequal number of cases/observations per group, you will have to compute a
weighted average (We will work on this issue soon).

tv = 1.71387152                         <------- this is t value corresponds to the df entered in step 2.
lsd = 6.0107738                         <------- this is the least significant difference or critical value that will be used for comparisons among the means.
Enter Method (-h for help):             <------- enter -h or other options
```

Let us use glsd to obtain the value of the area below T = 2 for Student's distribution with 5 degrees of freedom. In this case one would input

```
> glsd -T
Enter df value : 5
Enter T  value : 2

Area value for T = 0.9490303
```

As with all commands in glsd, there is no need to interact with the program through a series of prompts. One can obtain the result directly from the command line, by passing the parameters 5 and 2 directly as

```
> glsd -T 5 2
Area value for T = 0.9490303
```

The difference between these two invocations of the program is that in the first, glsd will assume that you still want to interact with the program after you consult the values of Student's distribution, but in the second, glsd will exit after it outputs the value of the area below T = 2 for the distribution with 5 degrees of freedom. The second invocation is appropriate for those that would prefer to call glsd from a script.

In any case, in both cases the order in which the parameters are given to glsd is the same, first the degrees of freedom, and then the T value.

All of the the previous remarks apply also to all commands described below.

As another example, we can find critical values of the Chi-square distribution. To obtain critical values, one uses the prefix "c" to the distribution, so in this case, one calls the program with the option -cX. Below is an example.

```
> glsd -cX
Enter df value =  6
Enter the p  value = .05

Critical Chi-square = 12.5915872
```

This value means that the area below X=12.5915872 for the Chi-square distribution with 6 degrees of freedom is 0.95.

Glsd also prints tables of values of these distributions, as you can find in many books. These tables can be customized in many ways. Tables are written in html, so that they can be seen in the browser of your choice. The prefix used to produce tables is "t", so a table of  the Normal distribution is obtained with the option -tZ. Here is an example

```
> glsd -tZ
One or two tailed list     : 3
Enter Bottom (default 0.0) : 0.0
Enter Top (default 4.0)    : 1.5
Enter Step (default 0.01)  : 0.01
```

In this case, glsd asks if you would like to a one or two tailed list. To request a one tailed list, one would input "1", for a two tailed list one would input "2". In our example above we input the value "3", which will output both tables.

For the other options, you can input the lowest Z value (in this case 0.0). You can accept the default by pressing return, also input the highest Z value (in this case 1.5) and the step (set to 0.01). The step is the difference between two consecutive Z values in the table. Once glsd prints the output (omitted here), one can cut and paste such  output into a file (say "tableZ.html"), and open such file into a browser. However, the same can be accomplished with the command

```
> glsd -tZ 3 0.0 0.1 0.01 > tableZ.html
```

which sends the output of glsd directly into the file tableZ.html. Finally, one can use glsd to print tables of critical values of the supported distributions. For example, we can  print a table of critical values of Student's distribution. In this case, to produce both, a one tail and a two tail table of Student's distribution for the degrees of freedom 4, 9, 12 and 15, with P values 0.01, 0.03 and 0.05, one can input

```
> glsd -tcT
One or two tailed list  : 3
Enter df list           : 12 4 9 15
Enter P  list           : 0.03 0.05 0.01
```

Observe that it is not necessary to input each list sorted, since glsd will sort these numbers for you before it prints the output.

Observe that if you wanted to get the table from the command line, then in order to not to confuse which values belong to each list, these must be enclosed between quotes. For example, one can produce the previous table using the command:

```
> glsd -tcT 3 "12 4 9 15" "0.03 0.05 0.01" > result.html
```