

## Lab Handout

## Lab 1.1: All Thumbs

The instructions below are keyed to the lab instructions found on pp. 29-30 of the text. Please use those instructions as well in preparing your report. Please include all relevant SAS outputs in your report.

### Experimental Procedure

#### Data Collection

1. Use the stopwatch in the web site:  
[http://www.math.wpi.edu/Course\\_Materials/SAS/stopwatch.html](http://www.math.wpi.edu/Course_Materials/SAS/stopwatch.html)  
to record the elapsed time between two clicks on the start/stop button (each group member has to take 20 measurements).
2. To obtain one measurement:
  - (a) Make sure the stopwatch is set to 0.
  - (b) Click the start/stop button to start the time running.
  - (c) Click the start/stop button as quickly as possible to stop the watch. (3)
  - (d) Have another group member record the elapsed time on paper.
  - (e) Reset the stopwatch and go to (a).
3. Continue until 20 measurements have been obtained.
4. Repeat this procedure for all group members.
5. On the data recording sheet (attached), record the sequence number, time and any comments about unusual occurrences.
6. After collecting the data, input it to SAS/INSIGHT. To use SAS/INSIGHT click *Solutions: Analysis: Interactive Data Analysis*. In the dialog box, click on *New*. SAS will open a blank spreadsheet. To analyze the data properly, you should create two data sets, as described in (a) and (b) below.
  - (a) For the first data set, input the data for everyone in your group, putting the student's name in the first column, the order in the second column and the time in the third column. Name the variables by clicking on the triangle directly under *File* at the upper left of the spreadsheet, and choosing *Define Variables*. Let's assume you choose the names STUDENT, ORDER, and TIME.  
Now save your SAS/INSIGHT spreadsheet as a SAS data set. To do this click on *File: Save: Data...*. If you want to save the data to a permanent data set (so that you will have it the next time you use SAS), select the Library SASUSER, and then type in a name for your data set. If you want only a temporary data set, select the Library WORK. Let's assume you give the data set the name LAB1\_1A.  
Later, you will use data set LAB1\_1A to create stratified plots of time versus student, as described below.
  - (b) To input the second data set, go to the SAS/INSIGHT spreadsheet for the first data set, and select *File: New*. This will bring up a new spreadsheet. In column 1, input the order of the observations. In column 2, input the corresponding times for student 1, in column 3, input the times for student 2, and so on. Give these variables names. Let's assume you give them the names ORDER, TIME1 TIME2, and so on.  
Save the spreadsheet to a SAS data set as described above. Let's assume you give the data set the name LAB1\_1B.  
Later, you will use data set LAB1\_1B to draw time series plots for each student, and to draw moving average plots, as described below.
7. Ignore item 7 in the text. Work with just your group's data set.

## Analysis

1. First, clean up your data, i.e. decide what to do about any observations that do not belong (for example, if an observation is larger than any other by a factor of 10 check to see if it has been recorded incorrectly). If there is a strange observation decide what you are going to do with it: treat it separately or delete it. Give your explanations.
2. Use appropriate plots to decide if the process that produced the data is stationary. What is your conclusion? Explain.

**To draw multiple time series (line) plots in SAS/INSIGHT:** Use the LAB1\_1B data. Click *Analyze: Line Plot*. Choose TIME1, TIME2, etc., as the Y variables, and TIME as the X variable.

**To draw a moving average plot:** From one of the original SAS windows (not a SAS/INSIGHT window) click: *Solutions: EIS/OLAP Application Builder* In the resulting window, click on *Applications* (click twice very fast). In the dialog box, click on *Run private applications*. Scroll down in the next window and click once on *TSMAPRED*. An input window will appear. Input the following information:

- (a) The name of the SAS data set containing the data (SASUSER.LAB1\_1B, if that was the name you chose).
- (b) The name of the SAS data set to contain the output (any name).
- (c) The name of the variable to be smoothed (TIME1 or TIME2 or ...).
- (d) The name of the variable to contain the smoothed series (any name).
- (e) The name of the variable to contain the residuals (any name).
- (f) The name of the time variable (ORDER).
- (g) The number of terms in the moving average (4 or 5 usually works well, though you are free to play with this).

You will have to do a separate moving average plot for each student.

Determine if the process is stationary. Explain the reasons for your conclusion, and back up your explanation with one or more graphs.

3. If the process is stationary, use a stratified plot to decide if the principal source of variation is within the times for the various individuals or between different individuals.

Normally, you should not use a stratified plot to analyze a nonstationary process. However, for the purposes of this lab, if you see that the process is not stationary, pretend that it is stationary and use a stratified plot to decide if the principal source of variation is within the times for the various individuals or between different individuals. Explain your conclusion based on the stratified plot.

**To draw a stratified plot of TIME stratified by STUDENT in SAS/INSIGHT:** Use the LAB1\_1A data. Click *Analyze: Scatter Plot* and choose TIME as the Y variable, ORDER as the X variable and STUDENT as the group variable.

## Lab 1.1 Data Sheet

**Student:**

Trial	Time	Comments
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
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