

**Name:** Fred Flintstone, Barney Rubble and Dino

**Lab Number:** 1.1

## Objectives

To give us a practical understanding of stationarity and between and within sources of variation.

## Experimental Procedure

### Data Collection

Each of us used the web stopwatch to obtain 20 measurements as instructed in the lab handout. We input the data into SAS/INSIGHT.

### Analysis

1. We began by looking for unusual data values. Barney had one large value near the beginning of his trials which he attributed to learning to use the stopwatch. Fred's last measurement was much larger than the other 19. He has no explanation for this. Dino had several very large measurements among the 10th through 15th. Fred believes he was distracted when Barney began eating a candy bar, but he isn't certain about this. In the absence of definite causes for the large measurements, we decided to keep them in the data for this analysis.
2. Figure 1 shows a line plot of the stopwatch measurements for each of us. Figures 2- 4 show individual time series (line) plots with a 4-term moving average superimposed.  
Despite the unusual observations, Fred's and Barney's times look reasonably stationary, although there is a hint of a small downward trend. Dino's plots show the unusually large measurements mentioned above. Even ignoring these measurements, there seems to be an upward trend, which makes stationarity questionable for Dino.
3. Even though stationarity is questionable, we graphed a stratified plot of the times (Figure 5), as instructed. The extreme observations are evident in this plot. But even discounting these extreme observations, we can see that Dino's within variation is larger than Fred's or Barney's, which themselves appear roughly comparable. Also Dino's times are generally higher than either Fred's or Barney's, which are at roughly the same level. The between and within variation seem to account for about equal amounts of the total variation.

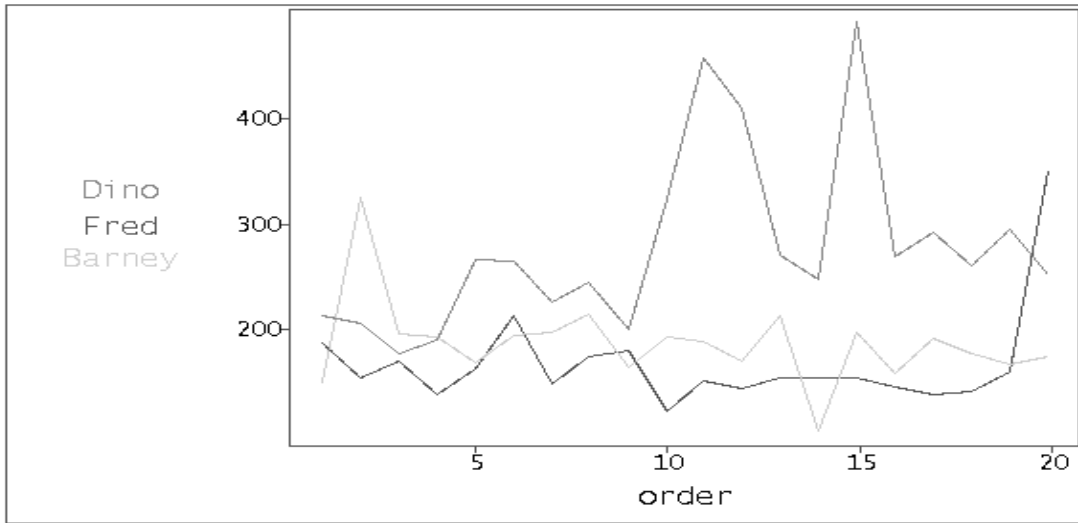


Figure 1: *Line plots of stopwatch measurements.*

### Series fred (Solid) and 4 Term Moving Average (Dotted)

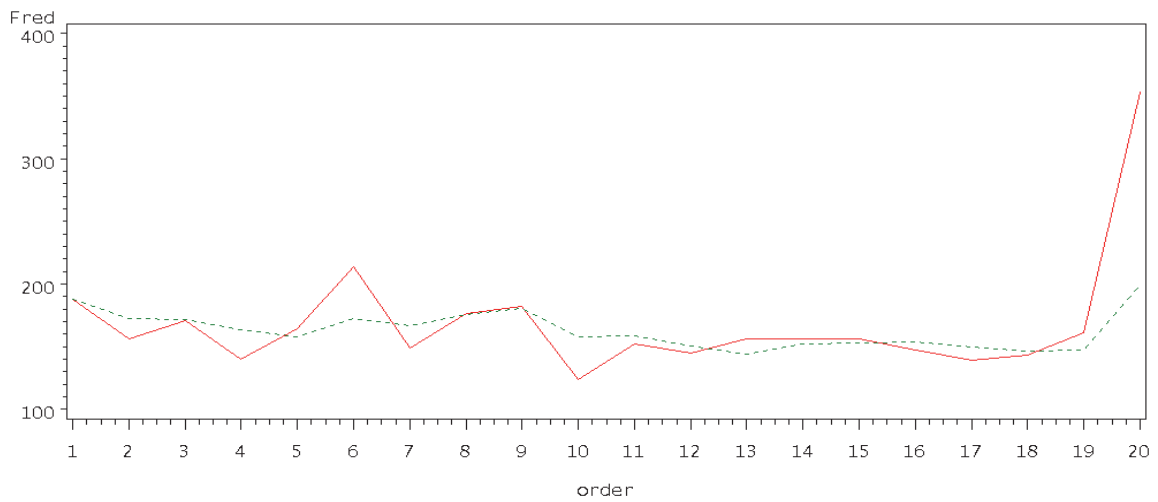


Figure 2: *Time series plot and 4 term moving average: Fred.*

### Series barney (Solid) and 4 Term Moving Average (Dotted)

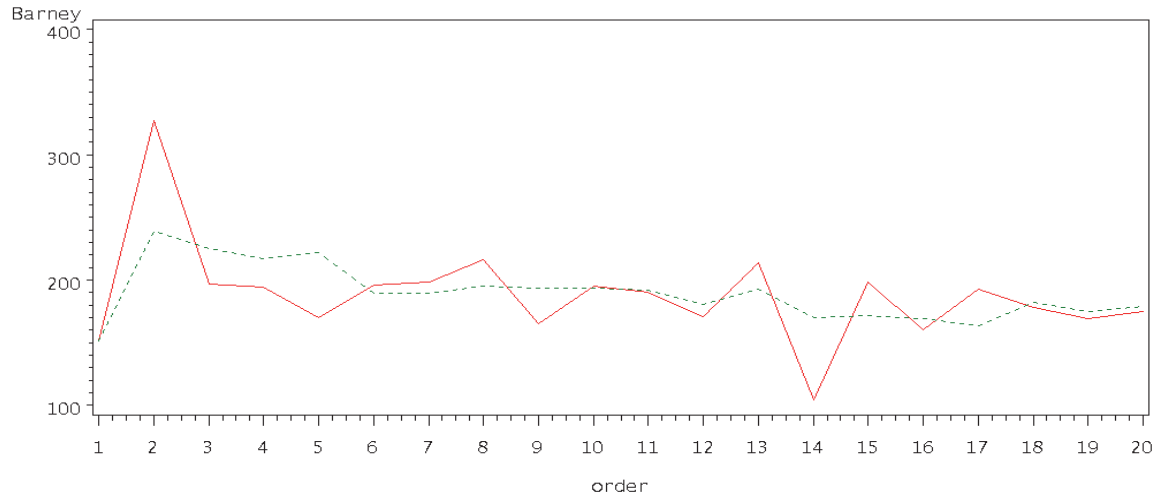


Figure 3: *Time series plot and 4 term moving average: Barney.*

### Series dino (Solid) and 4 Term Moving Average (Dotted)

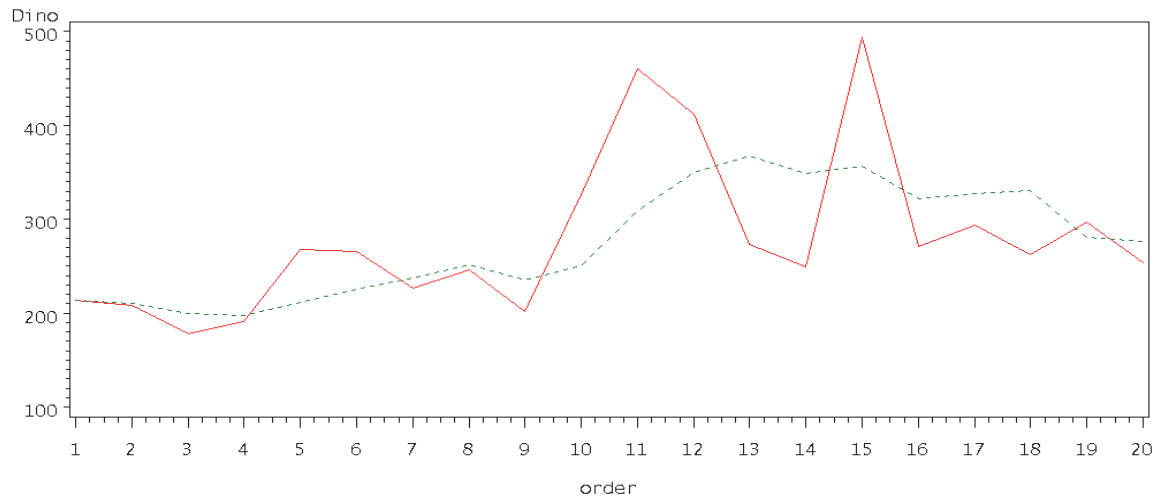


Figure 4: *Time series plot and 4 term moving average: Dino.*

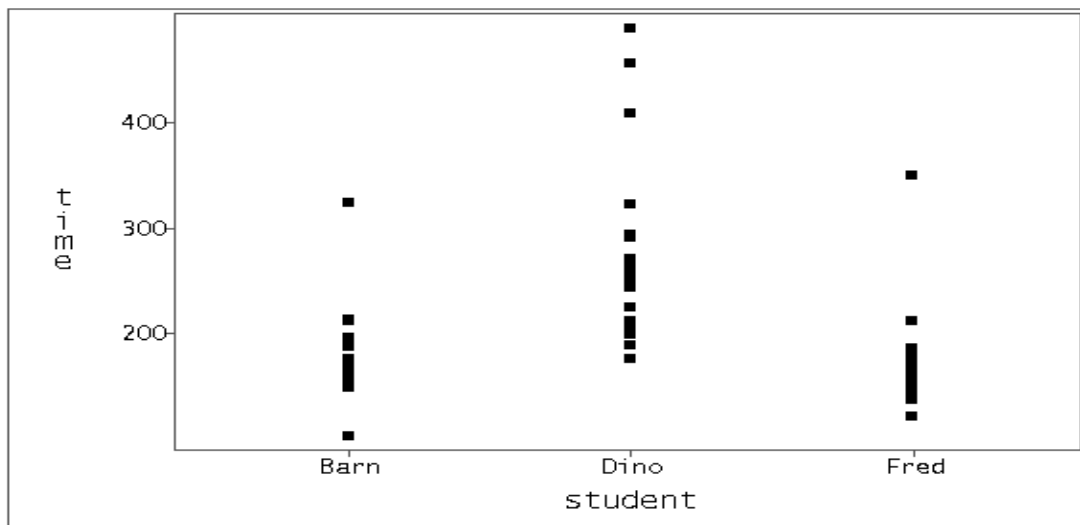


Figure 5: *Stratified plot of stopwatch measurements.*