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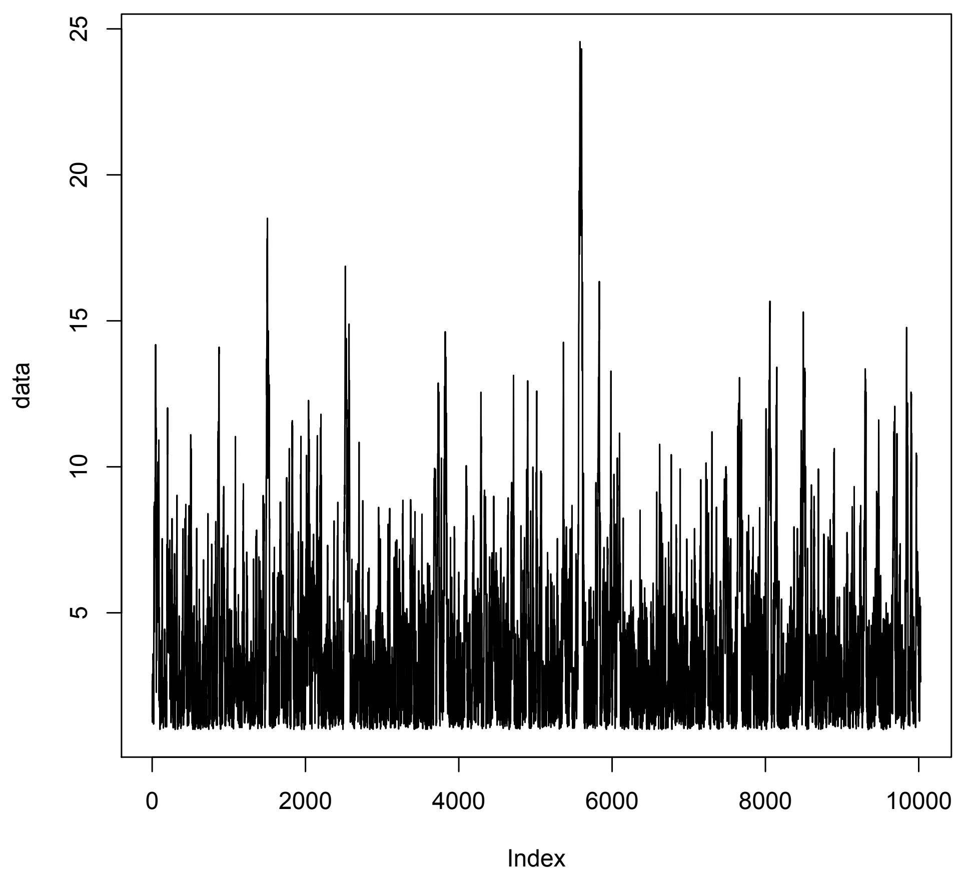
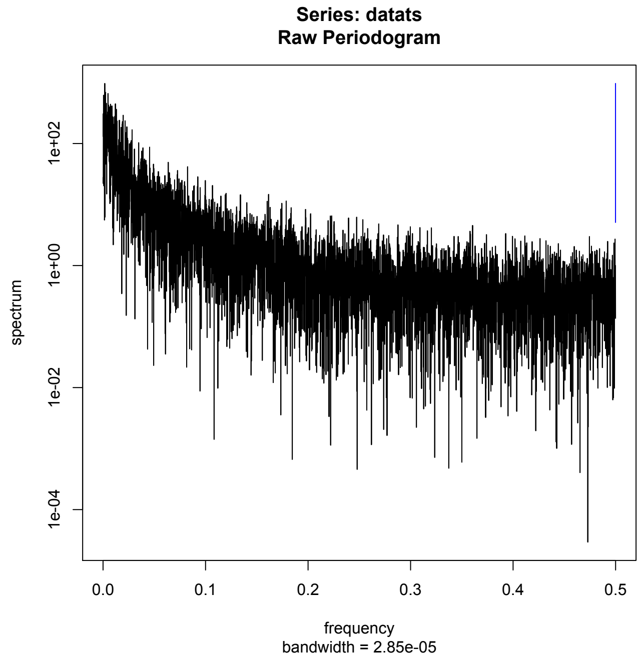
# CSCI 678: Statistical Analysis of Simulation Models
Homework 11

1. The average time in the system for a customer is $E[T] = E[W] + E[S]$, where $W$ is the time waiting and $S$ is the time in service. We see that $E[S]$ is the mean of a $U(1,2)$ process, which is 1.5, and $V[S] = 1/12$. We can further break down $E[W]$ into $E[n] * E[S] + E[r]$, where $n$ is the number of customers in line ahead of the arrival, $E[S] = 1.5$ as previously found, and $E[r]$ is the expected time remaining on the job being processed when the customer arrives. The solving for $E[n]$ and $E[r]$ is a long and arduous process, but after much wailing and gnashing of teeth (internet searching), we get that
$$E[T] = E[S]\left[\frac{1 + V[S]/E[S]^2}{2} * \frac{\lambda/\mu}{1 - \lambda/\mu} + 1\right]$$
plugging in our known values, we get that
$$E[T] = 3.8333...$$

2.



3.




We see a constant downward trend that levels off around .2. The height around lower frequencies tells us that the data is more correlated with longer periods; that is, the cyclic trend in the time series is rather long. When examining the data, this seems logical; we see regular periodic spikes every 5000 observations or so. The leveling off around .2 tells us that frequencies greater than .2 contribute equally to correlation. (Note: it's hard to tell the real periodic nature from the graph of wait times, because it's so dense and we don't know how to manipulate axes in R).

4. The program `asm11a.c` (attached at end) was used to find the confidence intervals. It's results are printed below:

```
(i)   Classic Confidence Interval:
      (3.503734,4.329389)

(ii)  Nonoverlapping Batch Mean interval:
      (3.674883,4.158240)

(iii) Overlapping Batch Mean interval:
      (3.656754,4.176369)

(vii) Standardized Time Series interval:
      (3.909522,3.923601)

mean wait: 3.916562
```