HOMEWORK ASSIGNMENT 3

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PROBLEM 1: Shiraz vs Chardonnay

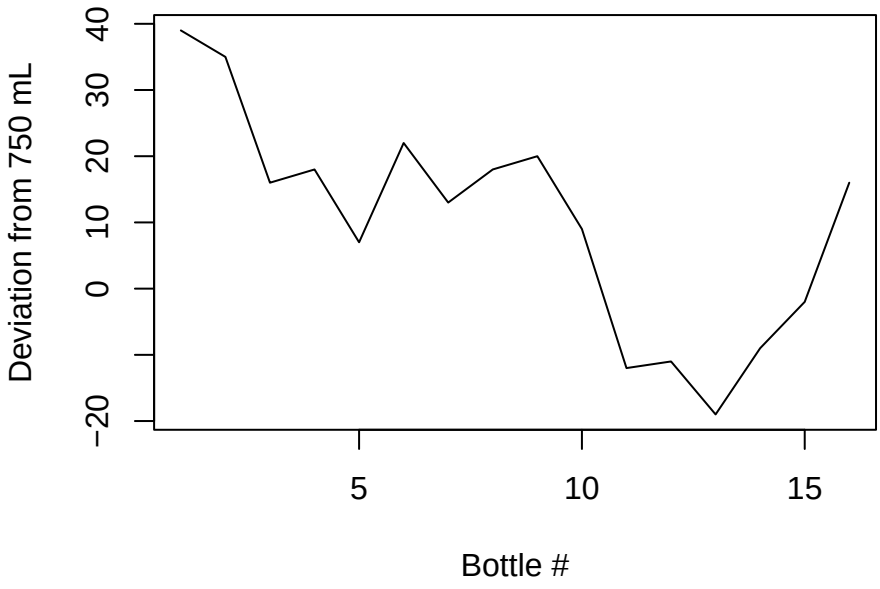
The data in `Serendipity.Rdata` are the volumes, relative to nominal contents of 750 ml, of 16 bottles taken consecutively from the filling machine at the Serendipity Shiraz vineyard. The data in `Cagey.Rdata` are the volumes, relative to nominal contents of 750 ml, of consecutive bottles taken from the filling machine at the Cagey Chardonnay vineyard.

(a) Use the `load()` function to read in the data from each data set. Don't forget to run `attach()` on your data frame after loading it.

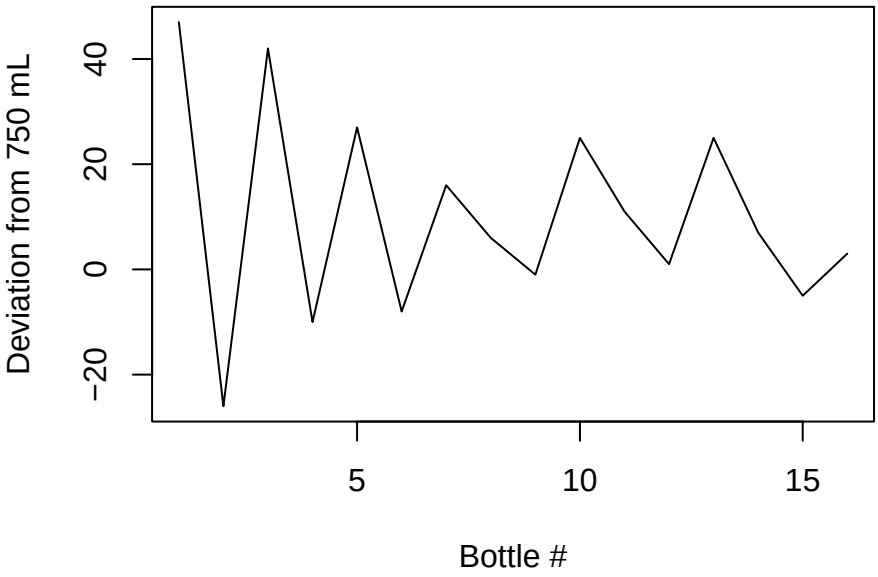
```
load("Serendipity.Rdata")
attach(dfSS)

load("Cagey.Rdata")
attach(dfCC)
```

(b) Produce time plots of the two time series. What do you notice?

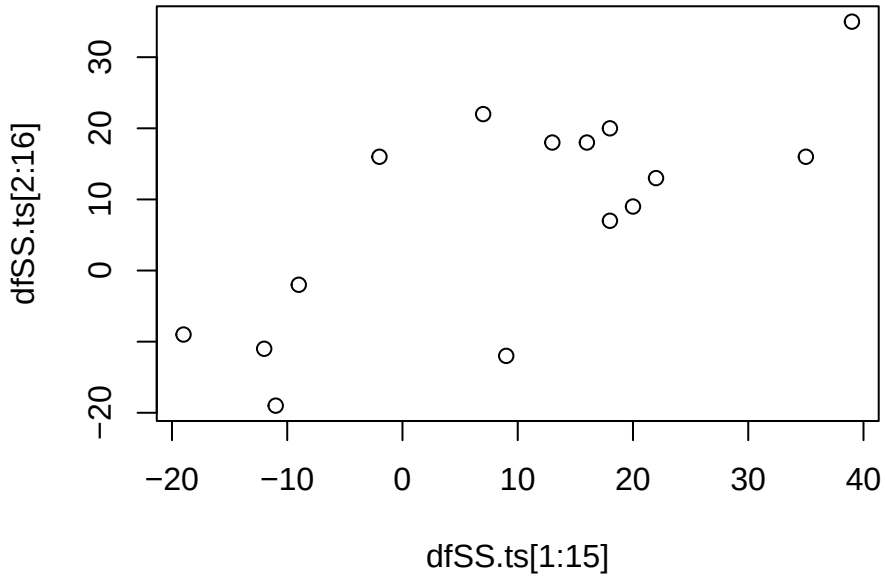


For the 'Serendipity' data, I see a roughly decreasing function until around Bottle 12. Afterward, the function increases. Also, most of the values on this graph are above 0, suggesting that on average, this machine is overfilling bottles.

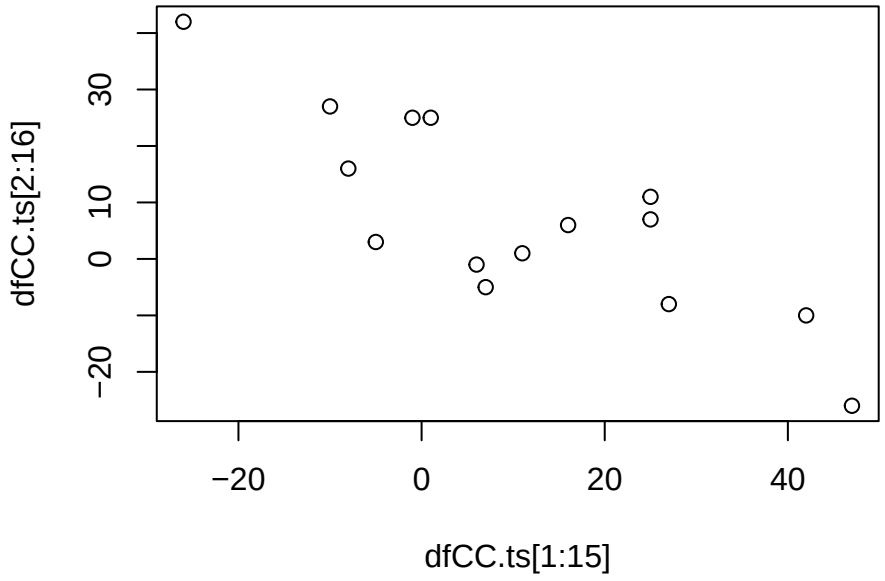


For the 'Cagey' data, I see a more sporadic function compared to the 'Serendipity' data. It appears as though there is a predicable pattern for how full a given bottle will be given a batch of n bottles.

(c) For each time series, draw a lag 1 scatter plot. Comment on what type of autocorrelation structure you expect to see for lag 1.

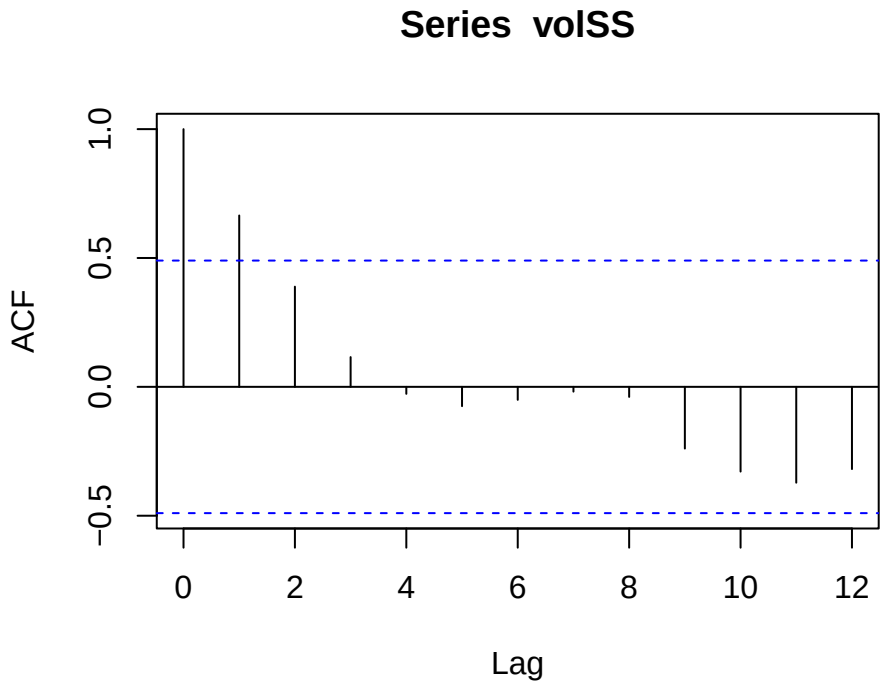


Since this data follows a rough linear trend, I'd expect to see positive autocorrelation at lag 1. This is what we see in this plot.

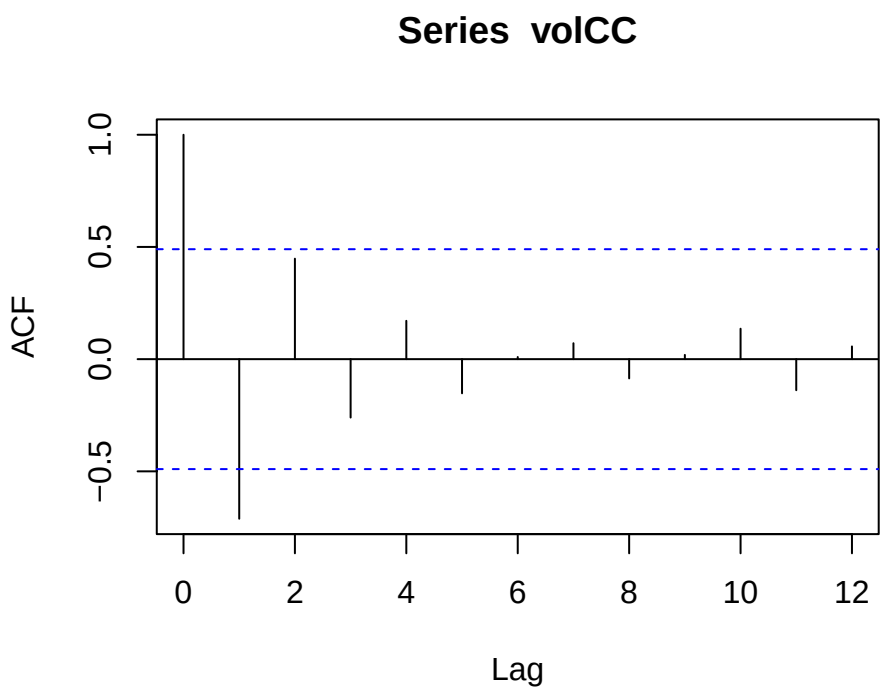


Due to the sporadic nature of this data, I would expect to see negative autocorrelation at lag 1 because the sign of the deviation from 750 mL changes for almost all lag 1 pairs. This is what we see in this plot.

(d) Produce the `acf` for both time series and comment on the structure in the plots.



The structure of this plot is strange, since we would expect that as lag increases, the magnitude of the autocorrelation decreases. However in this plot, this is not the case. For lag $= 4, ..., 8$, the autocorrelation is close to 0, but increases for lags greater than 8.

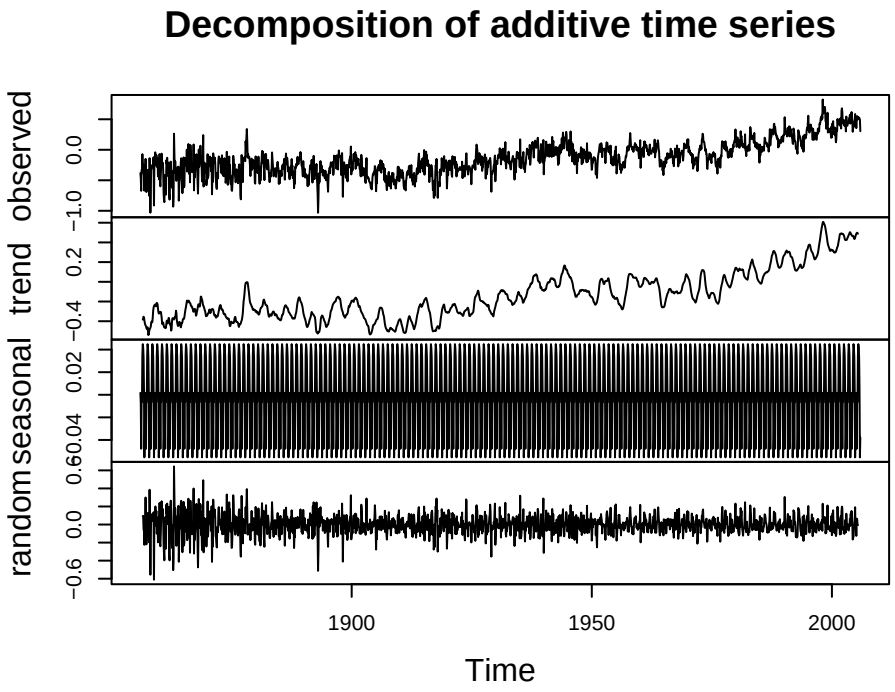


The structure of this plot is closer to what is expected. The magnitude of the autocorrelation roughly decreases as lag increases.

PROBLEM 2: Global temperature series

Carry out the following exploratory time series analysis using the global temperature series from Section 1.4.5.

(a) Decompose the series into the components trend, seasonal effect, and residuals. Plot these components. Would you expect these data to have a substantial seasonal component?



Since this is a time series of average global temperature, I would expect that there be a substantial seasonal component due to regional climate changes based on the seasons, or lackthereof.

(b) Compare the standard deviation of the original series with the deseasonalised series. Produce a plot of the trend with a superimposed seasonal effect.

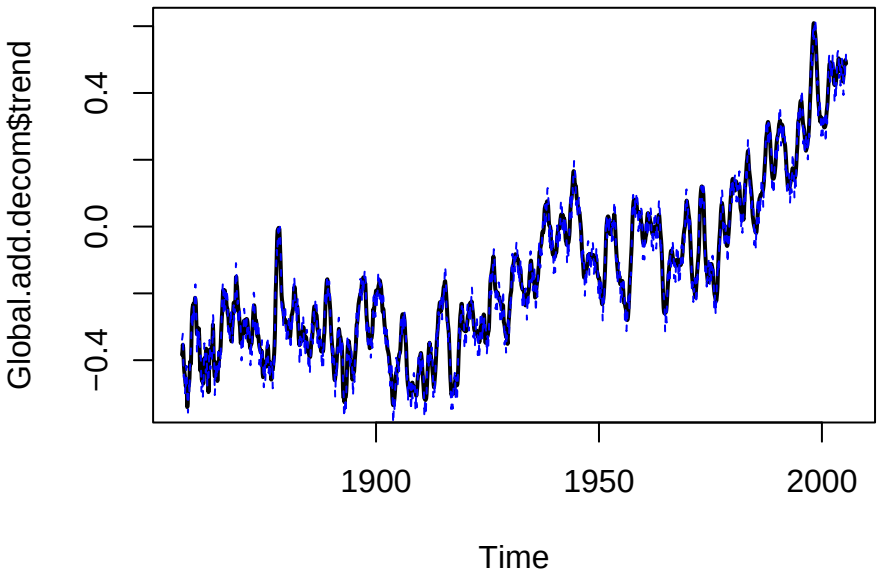
```
## Standard Deviation
sd(Global.month.ts) ## Original Series
```

```
## [1] 0.273536
```

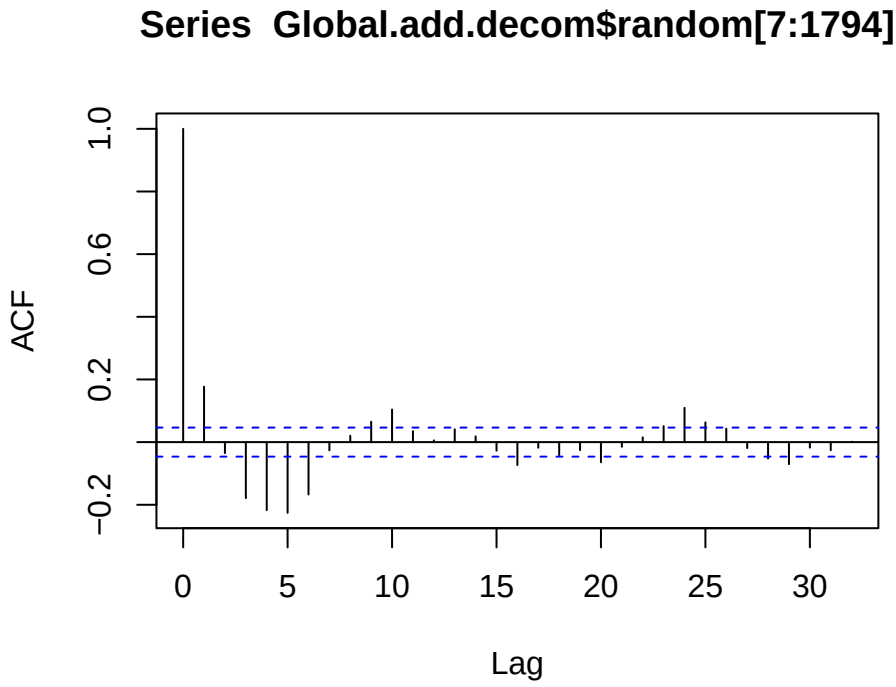
```
sd(Global.month.ts - Global.add.decom$seasonal) ## Deseasonalized Series
```

```
## [1] 0.2715033
```

The Standard Deviation for the deseasonalized series is slightly smaller than that of the original series.



(c) Plot the correlogram of the residuals (random component) from part (a). The first 6 and last 6 observations are not numbers, so plot point between 7 and 1794. Comment on the plot, with particular reference to any statistically significant correlations.



The correlogram of the residuals appears to be a dampened cosine wave. For lags 1 to 6, the autocorrelation is greater than that corresponding to the confidence band. However, for lags greater than or equal to 7, the autocorrelation generally falls within the confidence band.