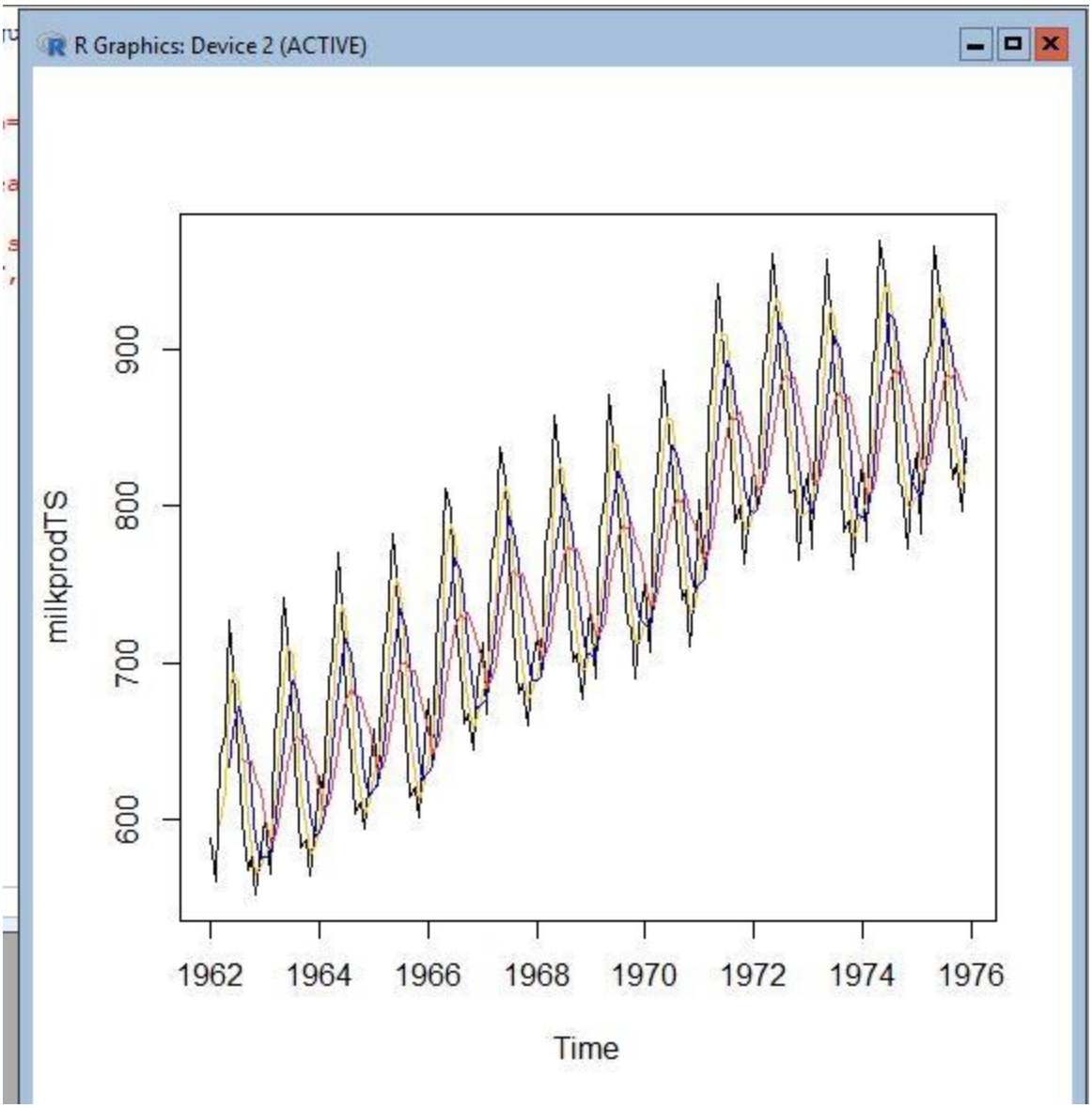
2. Consider the time series on Milk production data milk-production(1).csv it shows cow milk production per pound from 1962 to 1975.

a. Try at least three different values for window size with simple moving average (SMA) for forecasting

```
> library(TTR)
> milkprod<-read.csv(file=" G:/Fall Semester 2017/ISL/Assignment-3/milk-production.csv",head=T,sep=",")
Error in file(file, "rt") : cannot open the connection
In addition: Warning message:
In file(file, "rt") :
  cannot open file ' G:/Fall Semester 2017/ISL/Assignment-3/milk-production.csv': Invalid argument
> milkprod<-read.csv("G:\Fall Semester 2017\ISL\Assignment-3\milk-production",head=T,sep=",")
Error: '\F' is an unrecognized escape in character string starting ""G:\F"
> milkprod<-read.csv(file="G:\Fall Semester 2017\ISL\Assignment-3\milk-production",head=T,sep=",")
Error: '\F' is an unrecognized escape in character string starting ""G:\F"
> milkprod<-read.csv(file=file="G:/Fall Semester 2017/ISL/Assignment-2/kc_weather_srt.csv",head=T,sep=",")
Error: unexpected '=' in "milkprod<-read.csv(file=file="
> milkprod<-read.csv(file="G:/Fall Semester 2017/ISL/Assignment-2/kc_weather_srt.csv",head=T,sep=",")
> milkprod<-read.csv(file="G:/Fall Semester 2017/ISL/Assignment-3/milk-production.csv",head=T,sep=",")
> library(TTR)
> milkprod<-read.csv(file=" G:/Fall Semester 2017/ISL/Assignment-3/milk-production.csv
+ ",head=T,sep=",")
Error in file(file, "rt") : cannot open the connection
In addition: Warning message:
In file(file, "rt") :
  cannot open file ' G:/Fall Semester 2017/ISL/Assignment-3/milk-production.csv
': Invalid argument
> milkprodTS<-ts(milkprod$Pounds_per_Cow,frequency = 12,start=c(1962,1))
> plot.ts(milkprodTS)
> sTS3 = SMA(milkprodTS,n=3)
```

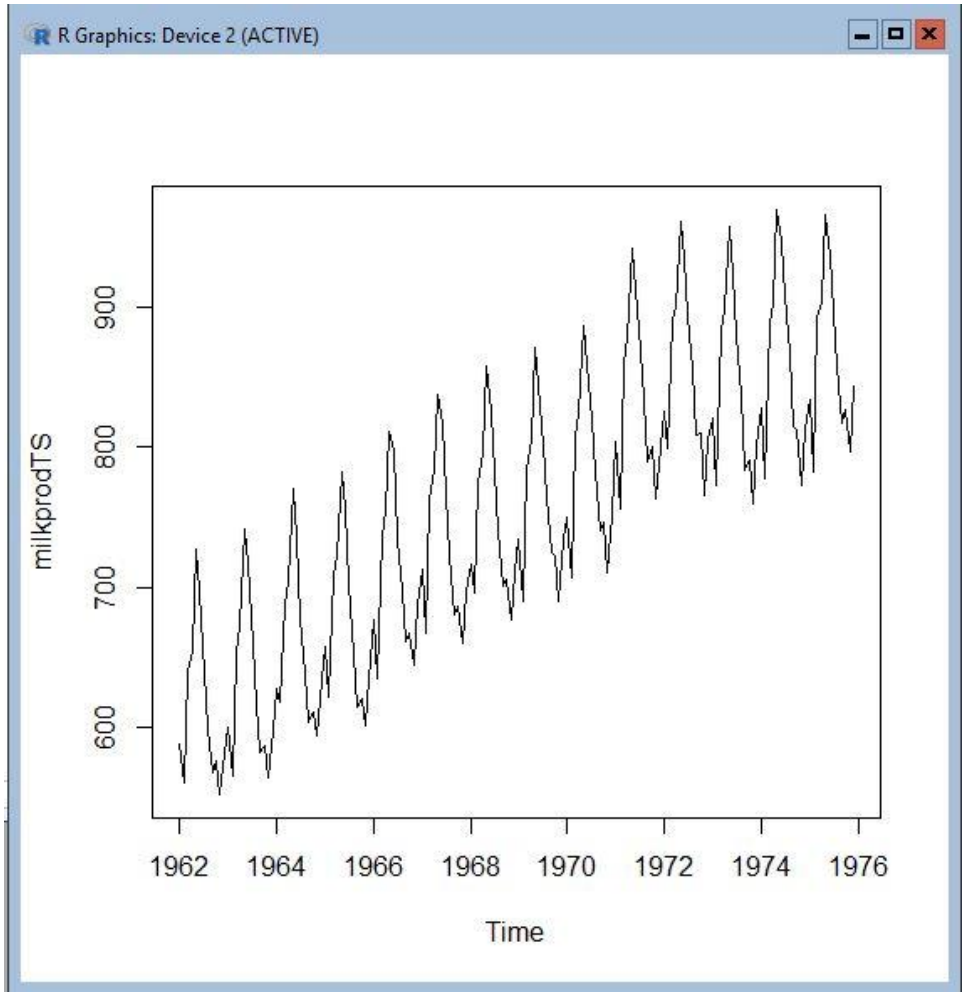
```
> milkprod<-read.csv(file="G:/Fall Semester 2017/ISL/Assignment-2/kc_weather_srt.csv",head=T,sep=",")
> milkprod<-read.csv(file="G:/Fall Semester 2017/ISL/Assignment-3/milk-production.csv",head=T,sep=",")
> library(TTR)
> milkprod<-read.csv(file=" G:/Fall Semester 2017/ISL/Assignment-3/milk-production.csv
+ ",head=T,sep=",")
Error in file(file, "rt") : cannot open the connection
In addition: Warning message:
In file(file, "rt") :
  cannot open file ' G:/Fall Semester 2017/ISL/Assignment-3/milk-production.csv
': Invalid argument
> milkprodTS<-ts(milkprod$Pounds_per_Cow,frequency = 12,start=c(1962,1))
> plot.ts(milkprodTS)
> sTS3 = SMA(milkprodTS,n=3)
> sTS5 = SMA(milkprodTS,n=5)
> sTS8  = SMA(milkprodTS,n=8)
> lines(milkprodTS, col="black")
> lines(sTS3, col="darkgoldenrod1")
> lines(sTS5, col="blue")
> lines(sTS8,col="brown1")
```


R Graphics: Device 2 (ACTIVE)
milkprodTS
600
700
800
900
1962
1964
1966
1968
1970
1972
1974
1976
Time

b. Apply exponential moving average using HoltWinters for forecasting

```
> milkprod<-read.csv( file="G:/Fall Semester 2017/ISL/Assignment-3/milk-production.csv ",head=T,sep=",")
> milkprodTS<-ts(milkprod$Pounds_per_Cow,frequency = 12,start=c(1962,1))
> plot.ts(milkprodTS)
> sHW = HoltWinters(milkprodTS,beta=FALSE, gamma=FALSE)
> sHW1 = HoltWinters(milkprodTS)
> sHWlines(sHW$fitted[,1], col= "green")
Error in sHWlines(sHW$fitted[, 1], col = "green") :
  could not find function "sHWlines"
> sHW1lines(sHW1$fitted[,1], col= "red")
Error in sHW1lines(sHW1$fitted[, 1], col = "red") :
  could not find function "sHW1lines"
> sHW
Holt-Winters exponential smoothing without trend and without seasonal component.

Call:
HoltWinters(x = milkprodTS, beta = FALSE, gamma = FALSE)

Smoothing parameters:
 alpha: 0.9999339
 beta : FALSE
 gamma: FALSE

Coefficients:
```

```
> sHW1
Holt-Winters exponential smoothing with trend and additive seasonal component.

Call:
HoltWinters(x = milkprodTS)

Smoothing parameters:
 alpha: 0.68933
 beta : 0
 gamma: 0.8362592

Coefficients:
          [,1]
a   885.775547
b     1.278118
s1  -16.743296
s2  -59.730034
s3   47.492731
s4   56.203890
s5  115.537545
s6   84.554817
s7   39.580306
s8   -4.702033
s9  -54.554684
s10 -51.582594
s11 -85.953466
s12 -42.907363
```




C. For the above, discuss how the forecasting differs in terms of MAD and MFE and why one approach or the other is better.

```
> milkprod<-read.csv(file="G:/Fall Semester 2017/ISL/Assignment-3/milk-production.csv ",head=T,sep=",")
> milkprodTS<-ts(milkprod$Pounds_per_Cow,frequency = 12,start=c(1962,1))
> plot.ts(milkprodTS)
> sTS3 = SMA(milkprodTS,n=3)
> error = milkprodTS -  sTS3
> mfe3 = (sum(error,na.rm = TRUE)/length(error))
> mfe3
[1] 1.531746
> mad3 = (sum(abs(error),na.rm = TRUE)/length(error))
> mad3
[1] 29.69841
> sTS5 = SMA(milkprodTS,n=5)
> error1 = milkprodTS -  sTS5
> mfe5 = (sum(error1,na.rm = TRUE)/length(error1))
> mfe5
[1] 2.355952
> mad5 = (sum(abs(error1),na.rm = TRUE)/length(error1))
> mad5
[1] 46.67976
> sTS8 = SMA(milkprodTS,n=8)
> error2 = milkprodTS -  sTS8
> mfe8 = (sum(error2,na.rm = TRUE)/length(error2))
> mfe8
[1] 3.598958
> mad8 = (sum(abs(error2),na.rm = TRUE)/length(error2))
> mad8
[1] 55.39062
```

The Ideal value for MFE=0

Inference:

From the different N values we used, the better model would be N=3 as the average absolute error is 29.6 units where as others are more.