Homework 2

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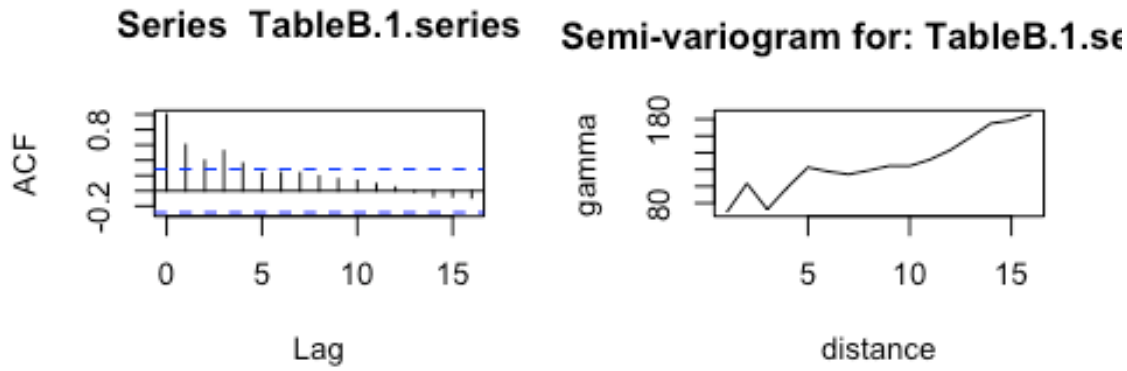
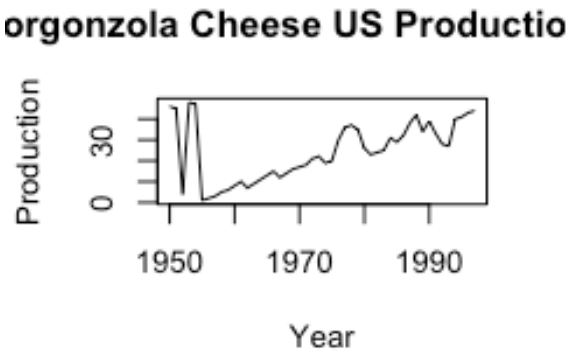
#2.2(a): Consider the data on US Production of blue and gorgonzola cheeses in Table B.4. a) Find the Sample autocorrelation function and the variogram for theses data. Is the time series a staionary or nonstationary?

```
TableB.1 <- read.csv("~/Desktop/GradSchool/Fall/STAT-
560/Homework/TableB.1.csv", header=T, sep = ",")
attach(TableB.1)
#install.packages("pastecs")
library(pastecs)
par(mfrow=c(2 ,2))
TableB.1.series <- ts(Production..103.lb.,start = 1950, end = 1997, frequency
= 1)
acf(TableB.1.series,plot = )
vario(TableB.1.series)
```

```
##    distance semivario
## 1         1  68.87234
## 2         2 103.39130
## 3         3  72.43333
## 4         4  99.01136
## 5         5 122.47674
## 6         6 117.61905
## 7         7 114.23171
## 8         8 118.93750
## 9         9 124.28205
## 10       10 124.18421
## 11       11 131.86486
## 12       12 143.16667
## 13       13 158.68571
## 14       14 175.00000
## 15       15 178.33333
## 16       16 185.70312
```

```
plot(TableB.1.series, main = " Blue & Gorgonzola Cheese US Production Time
Series",
     ylab = "Production", xlab = "Year")
```





##

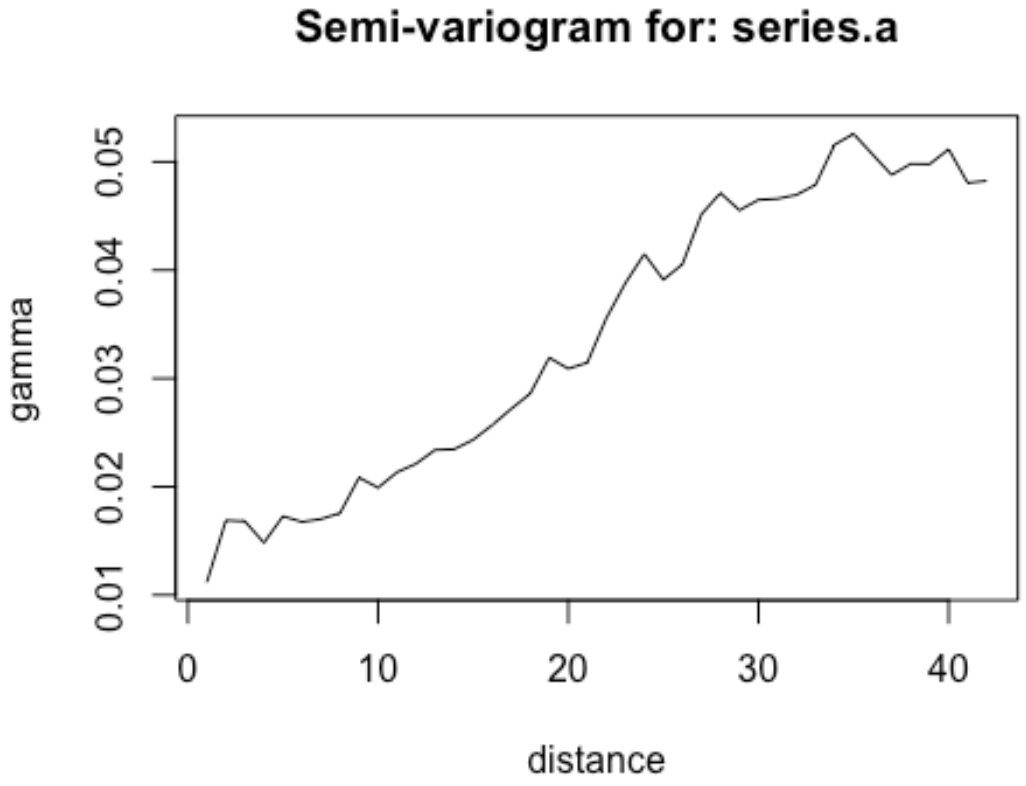
Given the increasing trend of both the variogram and the blue & gorgonzola cheese time series plot, it makes sense to conclude that the data is NOT stationary because it displays a non-stationary behavior. The sample ACF indicates a decreasing trend and the sample variogram is fluctuating.

#2.4 2.4) Table B.6 Contains two time series: the global mean surface air temperature anomaly ad the global CO_2 concentration. Find the sample autocorrelation function and the variogram for both of these time series. Is either one of the time series stationary?

```
TableB.6 <- read.csv("~/Desktop/GradSchool/Fall/STAT-
560/Homework/TableB.6.csv", header=TRUE, sep = ",")
attach(TableB.6[,c(1,2,3)])

## The following object is masked from TableB.1:
##
##     Year

library(pastecs)
series.a <- ts(Anomaly..C,start = 1880, end = 2004, frequency = 1)
acf(series.a,plot = F)

##
## Autocorrelations of series 'series.a', by lag
##
```

```
##     0     1     2     3     4     5     6     7     8     9    10    11
## 1.000 0.807 0.694 0.667 0.679 0.624 0.618 0.582 0.554 0.498 0.500 0.473
##    12    13    14    15    16    17    18    19    20
## 0.445 0.419 0.400 0.370 0.343 0.311 0.287 0.243 0.255
```

```
vario(series.a)
```

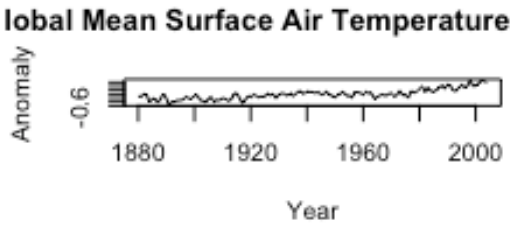


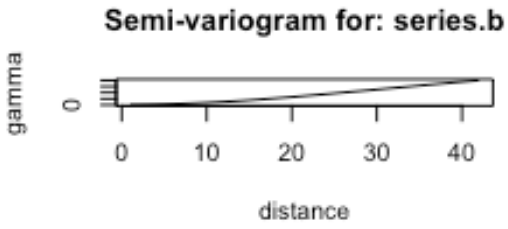

```
##    distance  semivario
## 1         1 0.01116976
## 2         2 0.01689268
## 3         3 0.01680205
## 4         4 0.01482438
## 5         5 0.01727083
## 6         6 0.01675042
## 7         7 0.01700932
## 8         8 0.01755684
## 9         9 0.02083707
## 10       10 0.01991522
## 11       11 0.02133772
## 12       12 0.02212434
## 13       13 0.02339866
## 14       14 0.02345586
## 15       15 0.02433227
```

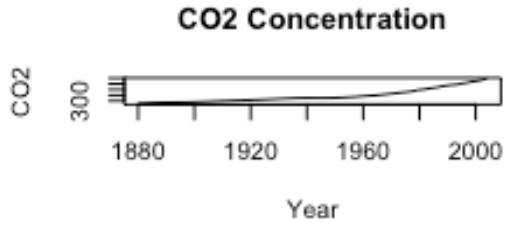
```
## 16       16 0.02569128
## 17       17 0.02718611
## 18       18 0.02859813
## 19       19 0.03191321
## 20       20 0.03089905
## 21       21 0.03145144
## 22       22 0.03555534
## 23       23 0.03879314
## 24       24 0.04149158
## 25       25 0.03911100
## 26       26 0.04053535
## 27       27 0.04515306
## 28       28 0.04711598
## 29       29 0.04554063
## 30       30 0.04649000
## 31       31 0.04659043
## 32       32 0.04695215
## 33       33 0.04788207
## 34       34 0.05158297
## 35       35 0.05258944
## 36       36 0.05068371
## 37       37 0.04879318
## 38       38 0.04980460
## 39       39 0.04979070
## 40       40 0.05116471
## 41       41 0.04805119
## 42       42 0.04825241

par(mfrow=c(3,2))
plot(series.a, main = "Global Mean Surface Air Temperature Anomaly", ylab =
"Anomaly", xlab = "Year")

library(pastecs)
series.b <- ts(CO2..ppmv,start = 1880, end = 2004, frequency = 1)
acf(series.b,plot = F)

##
## Autocorrelations of series 'series.b', by lag
##
##     0     1     2     3     4     5     6     7     8     9    10    11
## 1.000 0.966 0.933 0.900 0.868 0.837 0.805 0.774 0.744 0.714 0.684 0.655
##    12    13    14    15    16    17    18    19    20
## 0.627 0.598 0.569 0.540 0.512 0.483 0.456 0.430 0.404

vario(series.b)

##    distance   semivario
## 1         1   0.4356048
## 2         2   1.6714228
## 3         3   3.6236475
## 4         4   6.2718182
```

```
## 5          5   9.6330417
## 6          6  13.6957983
## 7          7  18.4098729
## 8          8  23.6302137
## 9          9  29.5075431
## 10        10  35.9424348
## 11        11  42.8599561
## 12        12  50.2376106
## 13        13  58.2819196
## 14        14  66.9610360
## 15        15  76.1637273
## 16        16  85.9185780
## 17        17  96.1670833
## 18        18 106.5560748
## 19        19 117.2751887
## 20        20 128.4167619
## 21        21 139.8720192
## 22        22 151.5795631
## 23        23 163.4627941
## 24        24 175.6733663
## 25        25 188.1794500
## 26        26 200.7160606
## 27        27 212.9849490
## 28        28 225.3575773
## 29        29 237.7077083
## 30        30 250.2016842
## 31        31 262.8575532
## 32        32 275.6955376
## 33        33 288.3227717
## 34        34 300.9579121
## 35        35 313.6961667
## 36        36 326.4555618
## 37        37 339.0259659
## 38        38 351.6102299
## 39        39 364.1934302
## 40        40 376.6161176
## 41        41 389.0563095
## 42        42 401.7012651
```

```
plot(series.b, main = "CO2 Concentration", ylab = "CO2", xlab = "Year")
```







From the increasing trends from both plots, I think they're both non-stationary