Fatmanur Yaman - 2019402204 - IE360 - ASSIGNMENT 1

Question 1

THE CODE:

```
#MA
moving_average_results = c()
simple_moving_average = function(data, k){
  len = length(data)
  for (t in 1:(len-k+1)){
    sum_mt=0
    for(j in 0:(k-1)){
      sum_mt= sum_mt+data[t+j]
    }
    m_t=sum_mt/k
    moving_average_results=append(moving_average_results, m_t)
  }
  return(moving_average_results)
}


#Forecasting
forecastor_results = c()
forecastor=function(ma, double_ma, k){
  len = length(double_ma)
  for (i in 1:len){
    print(ma[i+k-1])
    print(double_ma[i])
    forecast=(2*ma[i+k-1]-double_ma[i])+((2*(ma[i+k-1]-double_ma[i])/(k-1)))
    print(forecast)
    forecastor_results=append(forecastor_results, forecast)
  }
  return(forecastor_results)
}

#Forecasting New Observations
forecastor_last5_results=c()
forecastor_last5=function(ma, double_ma, k, t){
  len = length(double_ma)
  for (i in 1:t){

forecast=(2*ma[len+k-i]-double_ma[len])+((2/(k-1))*(ma[len+k-1]-double_ma[len])*i)
    forecastor_last5_results=append(forecastor_last5_results, forecast)
  }
  return(forecastor_last5_results)
}

#MSE
mse=function(actual,predicted,lag){
  mse_sum=0
  len=length(predicted)
  for (i in 1:len){
    print(actual[i+2*lag-2])
    print(predicted[i])
    squared_diff = (actual[i+2*lag-2]-predicted[i])^2
    mse_sum = mse_sum+squared_diff
  }
  mse=mse_sum/len
  return(mse)
```

```
}

#MAPE
mape=function(actual,predicted,lag){
  mape_sum=0
  len=length(predicted)
  for (i in 1:len){
    diff = actual[i+2*lag-2]-predicted[i]
    if (diff>0){
      diff
    } else{
      diff=-1*diff
    }
    final_diff = diff/actual[i+lag-1]
    mape_sum = mape_sum+final_diff
  }
  mape=mape_sum/len
  return(mape)
}
```

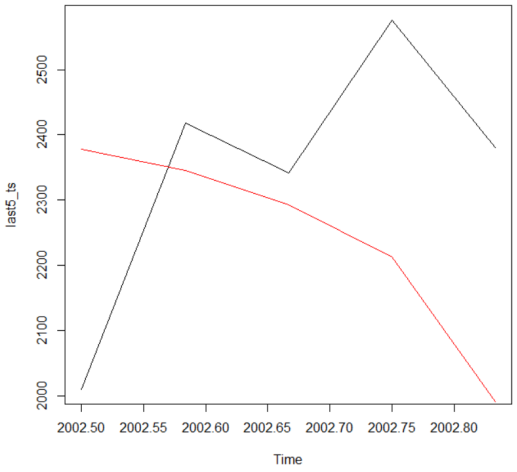
The MSE and MAPE for diff1:

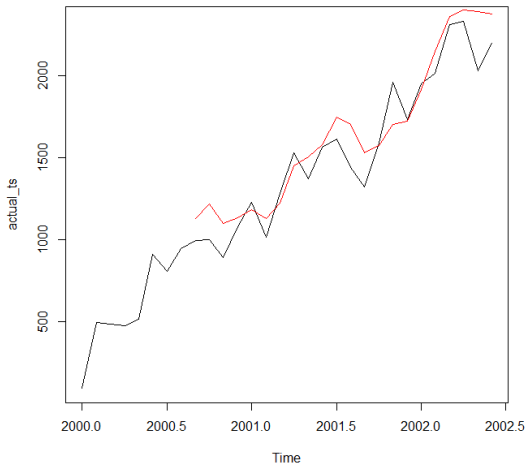
```
> mse_4
[1] 21707.44
> mape_4=mape(first_data,forecasts_4,4)
> mape_4
[1] 0.1069243
```

The MSE and MAPE for diff2:

```
> mse_5
[1] 24691.96
> mape_5=mape(first_data,forecasts_5,5)
> mape_5
[1] 0.1043646
```

diff1 Case Plots





Question 2

THE CODE:

```
sample_covariance=function(x,y){
  x_mean=mean(x)
  y_mean=mean(y)
  len=length(x)
  diff_sum=0
  x_diff_sum=0
  y_diff_sum=0
  for (i in 1:len){
    x_diff=x[i]-x_mean
    y_diff=y[i]-y_mean
    x_diff_sum=x_diff_sum+x_diff^2
    y_diff_sum=y_diff_sum+y_diff^2
    diff_sum=diff_sum+x_diff*y_diff
  }
  covariance_data=diff_sum/(len-1)
  x_sd=sqrt(x_diff_sum/(len-1))
  y_sd=sqrt(y_diff_sum/(len-1))
  correlation_data=covariance_data/(x_sd*y_sd)
  return(correlation_data)
}

sample_covariance(first_data[9:30],forecasts_5)

autocorrelation=function(x,k){
  len=length(x)
  x_mean=mean(x)
  sum_diff=0
  sum_mean=0
  for (i in (k+1):len){
    diff_sum=(x[i]-x_mean)*(x[i-k]-x_mean)
    sum_diff=sum_diff+diff_sum
  }
  for (i in 1:len){
    mean_sum=(x[i]-x_mean)^2
    sum_mean=sum_mean+mean_sum
  }
  autocorr_coef=sum_diff/sum_mean
  return(autocorr_coef)
}

autocorr_final=function(x,b){
  autocorr_list=c()
  for (j in 0:b){
    autocorr=autocorrelation(x,j)
    autocorr_list=append(autocorr_list,autocorr)
  }
  return(autocorr_list)
}

autocorr_final(first_data[9:30],10)

difference_list=c()
first_difference=function(x,k){
  len=length(x)
  for (i in (k+1):len){
```

```
    difference=x[i]-x[i-k]
    difference_list=append(difference_list,difference)
  }
  return(difference_list)
}
```

The Covariance of the Data:

> sample_covariance(first_data[9:30],forecasts_5)
[1] **0.9532155**

The autocorrelation of the data with the lags between 0 and 10:

> autocorr_final(diff_1,10)
 [1] 1.00000000 0.26473267 -0.24607451 0.05676779 -0.14929224 -0.58003547
 [7] -0.17430301 0.21661674 0.08789318 0.09354993 0.15941673

The MSE and MAPE for diff1:

> mse_5
[1] **55913.81**
> mape_5=mape(diff_1,forecasts_5_diff,5)
> mape_5
[1] **0.5072466**

The plot of dataset made by differences: