

## ASSIGNMENT 1

### Course: Financial Risk Management 1

1. Plot histogram of IBM stock prices, and used historical method to estimated value at risk at 5%

#To solve this problem, we need to install 2 packages in R, which are 'xts' and 'zoo'.

#These following codes provide the histogram of IBM stock prices

```
library(xts)
```

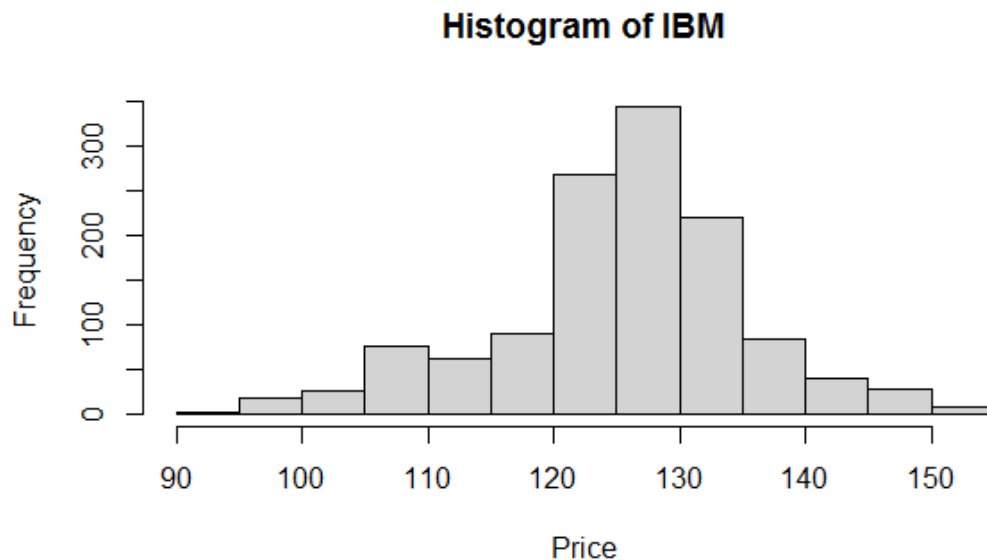
```
getSymbols("IBM", from = '2015-01-01',
```

```
to = "2019-12-31", warnings = FALSE,
```

```
auto.assign = TRUE)
```

```
IBM<- IBM[, 'IBM.Adjusted']
```

```
hist(IBM, xlab='Price')
```



#Estimate Value-at-Risk at 5%

```
Var_5_historical<-quantile(IBM, probs=0.05)
```

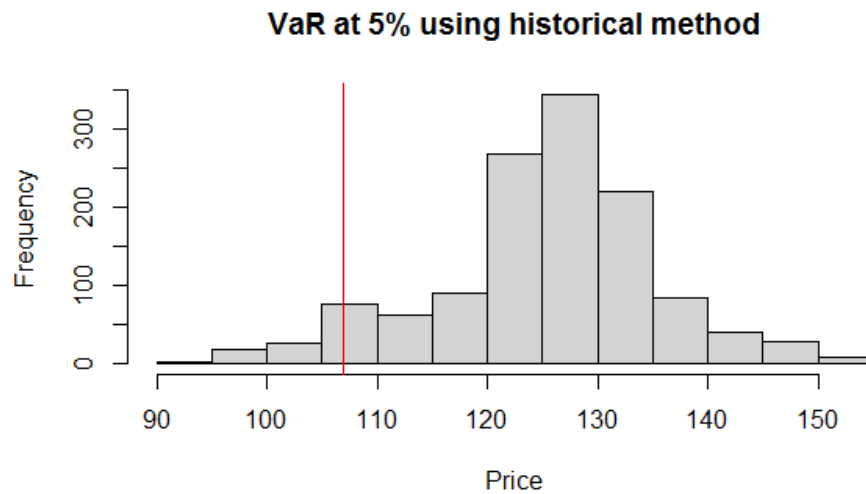
```
print(Var_5_historical)
```

```
## 5%
```

```
## 106.9431
```

```
hist(IBM,xlab='Price',,main='VaR at 5% using historical method')
```

```
abline(v=Var_5_historical,col='red')
```



2. You will find the latest price of IBM from your data (at date: 2019-12-30). Use Monte Carlo method with 1000 simulations to forecast the price of the next day and then forecast Value at Risk for the next day.

```
mu<-mean(diff(log(IBM),1)[-1,])
```

```
std<-sd(diff(log(IBM),1)[-1,])
```

```
St<-coredata(IBM[nrow(IBM),])[1,1]
```

```
simulate_price<-function(k){
```

```
  set.seed(k)
```

```
  dt=1
```

```
  dS=mu*St*dt+std*St*rnorm(1,mean=0,sd=sqrt(dt))
```

```
  S_t1=St+dS
```

```
  S_t1
```

```
}
```

```
new_data<-xts(matrix(rep(IBM,1000),ncol=1000),order.by=index(IBM))
```

```
simulate_data<-xts(matrix(rep(0,1000),ncol=1000),order.by=as.Date('2020-01-01'))
```

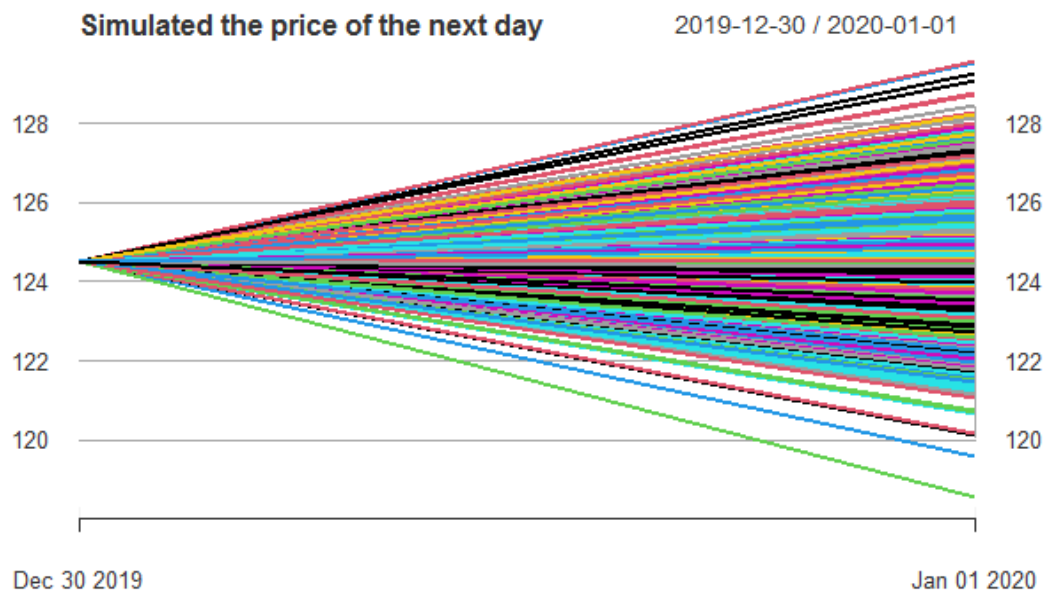
```
for(i in 1:1000){
```

```
  simulate_data[1,i]=simulate_price(i)
```

```
}
```

```
combine<-rbind(new_data,simulate_data)
```

```
plot(combine[1257:1258],main='Simulated the price of the next day')
```



```
Var_5_montecarlo<-quantile(combine[1258,],probs=0.05)
```

```
print(Var_5_montecarlo)
```

```
## 5%
```

```
## 121.8384
```

```
hist(IBM,xlab='Price',main='VaR at 5% using Monte Carlo')
```

```
abline(v=Var_5_montecarlo,col='red')
```

