

Homework5

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Question1

Part 1

The package has already been installed.

Part 2

```
# Loading the astsa library
library(astsa)
```

Part 3

```
# Examining series structures
str(EQ5)
```

```
## Time-Series [1:2048] from 1 to 2048: 0.01749 0.01139 0.01512 0.01477 0.00651 ...
```

```
str(flu)
```

```
## Time-Series [1:132] from 1968 to 1979: 0.811 0.446 0.342 0.277 0.248 ...
```

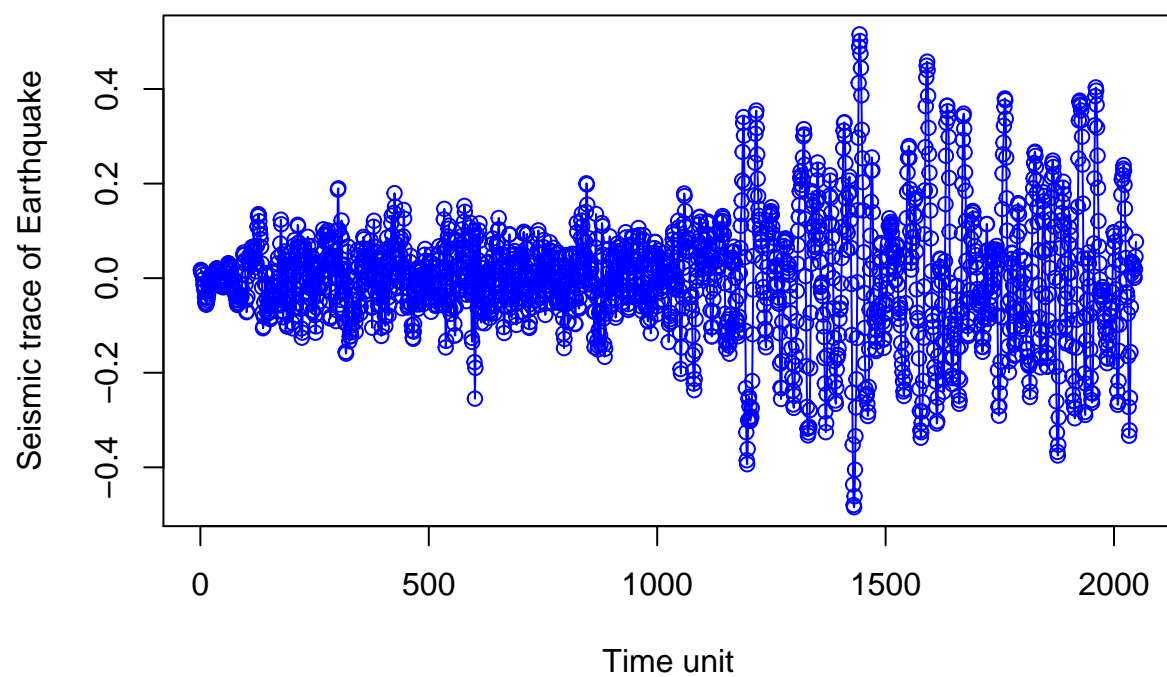
```
str(gas)
```

```
## Time-Series [1:545] from 2000 to 2010: 70.6 71 68.5 65.1 67.9 ...
```

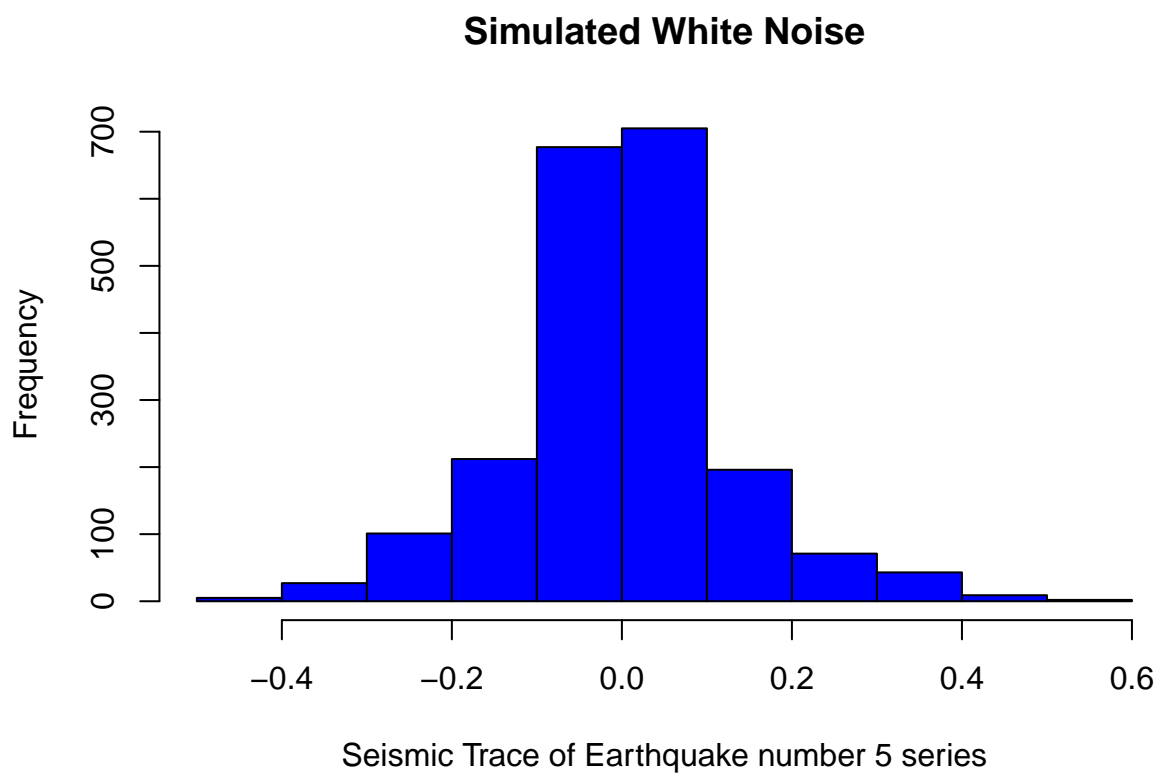
Part 4

```
# Plotting for EQ5
plot(EQ5, type = "o", main = "Seismic Trace of Earthquake number 5 series",
     ylab = "Seismic trace of Earthquake", xlab = "Time unit", col = "blue")
```

Seismic Trace of Earthquake number 5 series

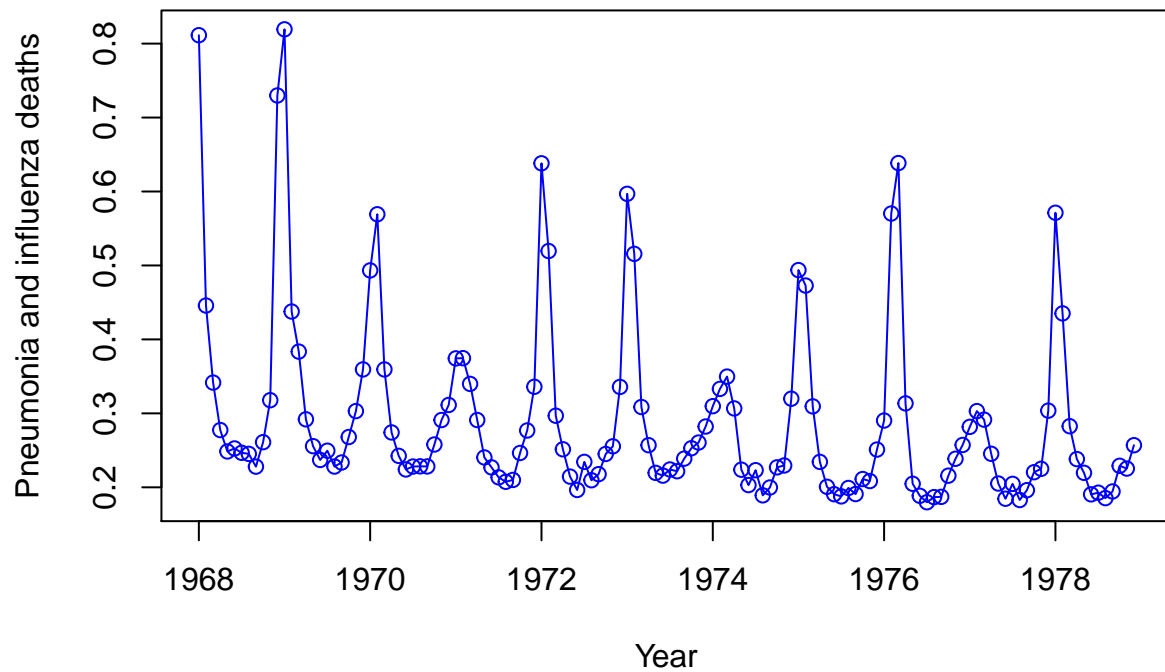


```
hist(EQ5, main = "Simulated White Noise", col = "blue", xlab = "Seismic Trace of Earthquake number 5 series",  
      ylab = "Frequency")
```



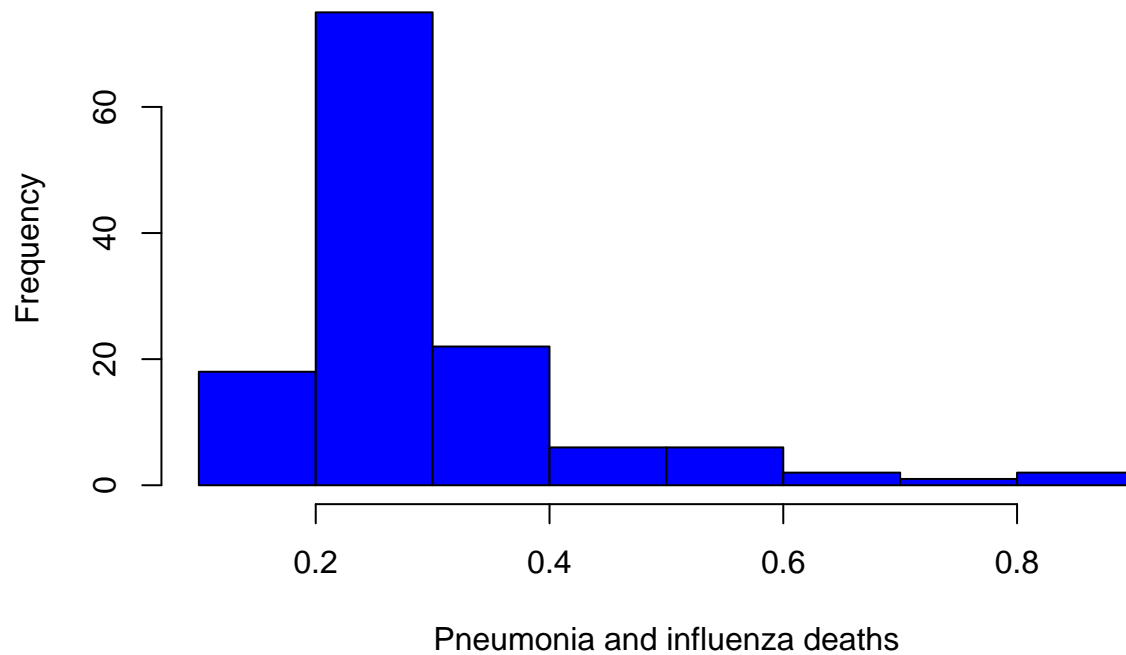
```
# Plotting for flu
plot(flu, type = "o", main = "Monthly pneumonia and influenza deaths in the U.S., 1968 to 1978",
     ylab = "Pneumonia and influenza deaths", xlab = "Year", col = "blue")
```

Monthly pneumonia and influenza deaths in the U.S., 1968 to 1978



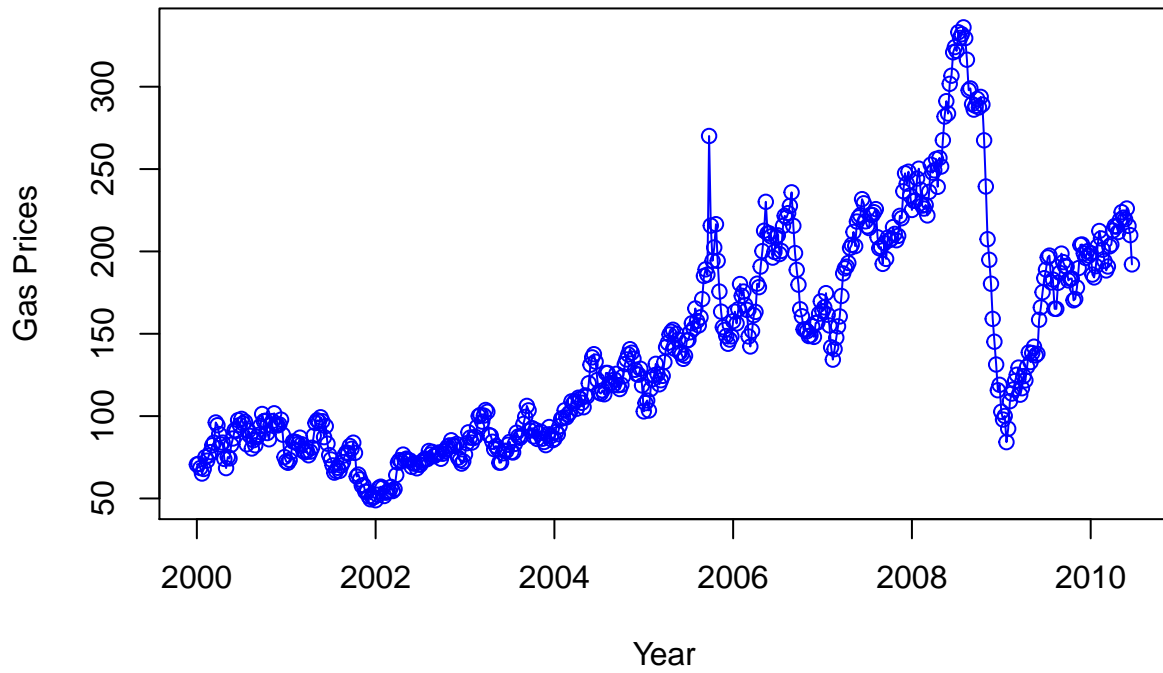
```
hist(flu, main = "Monthly pneumonia and influenza deaths in the U.S., 1968 to 1978",  
     col = "blue", xlab = "Pneumonia and influenza deaths", ylab = "Frequency")
```

Monthly pneumonia and influenza deaths in the U.S., 1968 to 1978



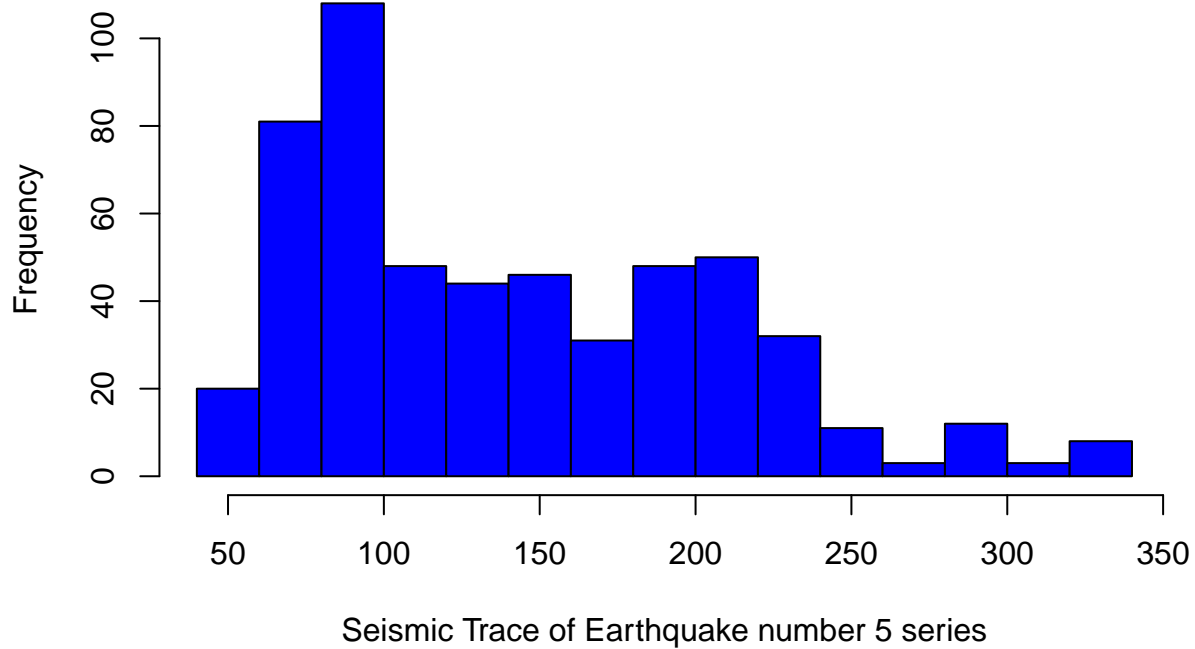
```
# Plotting for gas  
plot(gas, type = "o", main = "Weekly Gas Prices", ylab = "Gas Prices",  
      xlab = "Year", col = "blue")
```

Weekly Gas Prices



```
hist(gas, main = "Simulated White Noise", col = "blue", xlab = "Seismic Trace of Earthquake number 5 se",  
     ylab = "Frequency")
```

Simulated White Noise



Part 5

EQ5 - Mean of the series stable around 0. Amplitude/Volatility of the series increases sharply around time unit 1000, and fluctuates.

flu - Seems to be a downward trend from the 60's leading into the 70's. After this, the trend remains flat with a steady seasonal variation with some years worse than others.

gas - The weekly gas price forms a downward trend from 200-2002, upward trend from 2002 - 2009, a sharp decrease in 2009, and a gradual increase from 2009 onwards.

Question 2

Example 1 -> Number of users adopting new product feature at social media startup (daily data for 1 year). The graph follows an upward trend for three months, corresponding to the initial promotion of the feature, followed by a flattening of the line.

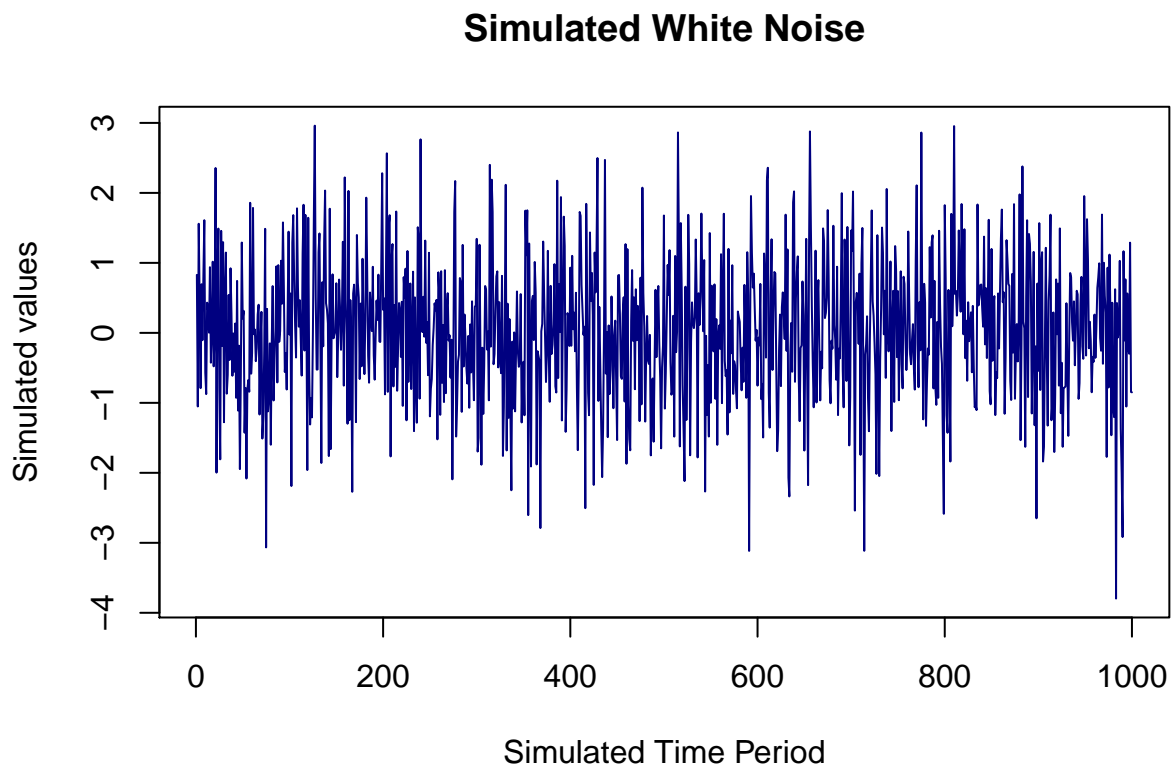
Example 2 -> The daily stock price of TSLA in the past 3 months. The price followed a steady downward trend until the past few weeks when it has made an upward trend.

Example 3 -> Another example.

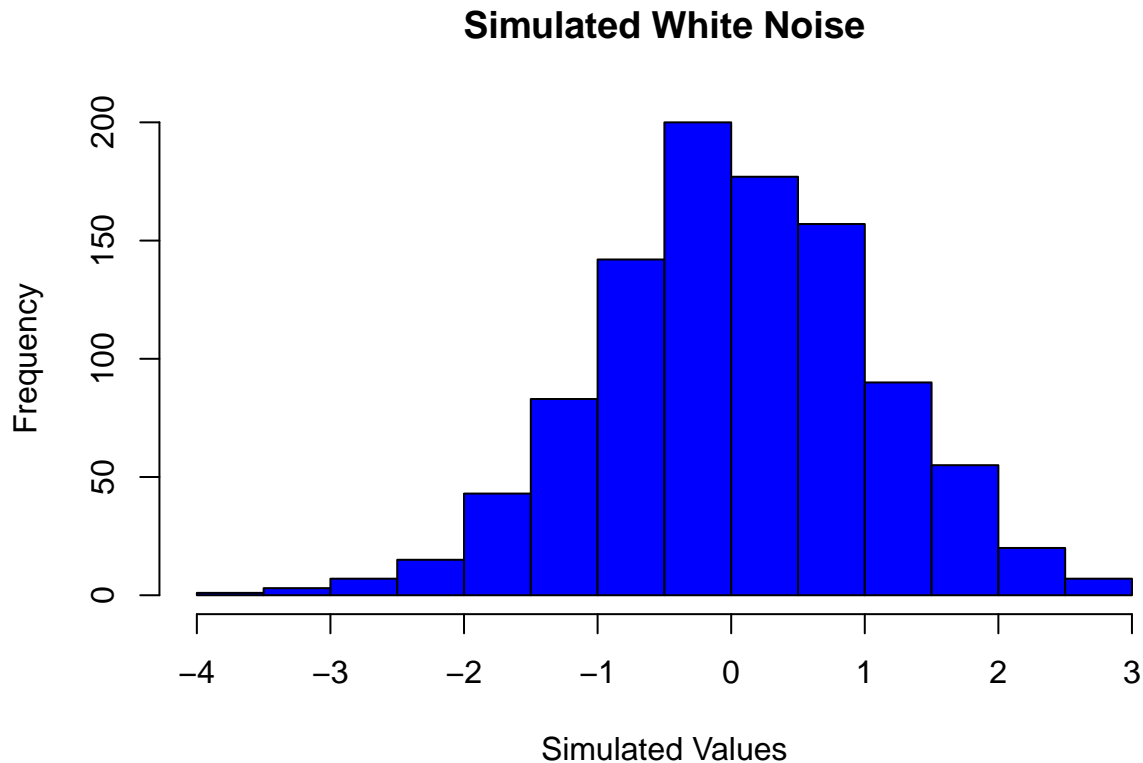
Question 3

```
# Simulating white noise
white.noise = rnorm(1000, 0, 1)

# Plotting timeplot, histogram
plot.ts(white.noise, main = "Simulated White Noise", col = "navy", ylab = "Simulated values",
        xlab = "Simulated Time Period")
```



```
hist(white.noise, main = "Simulated White Noise", col = "blue", xlab = "Simulated Values")
```

Question 4

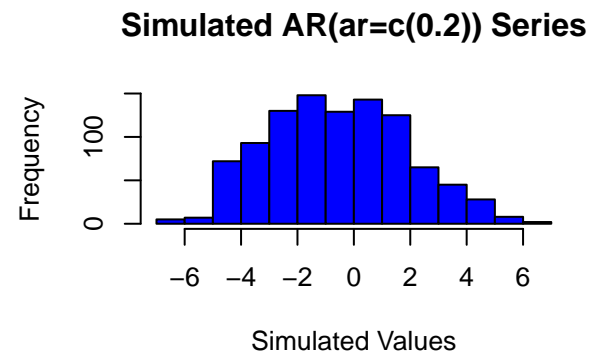
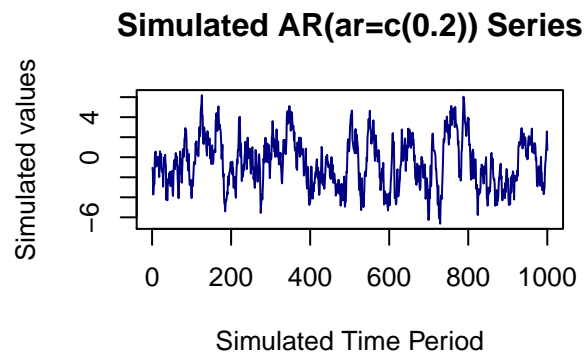
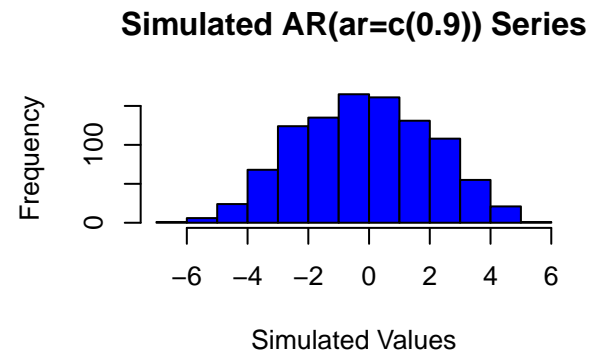
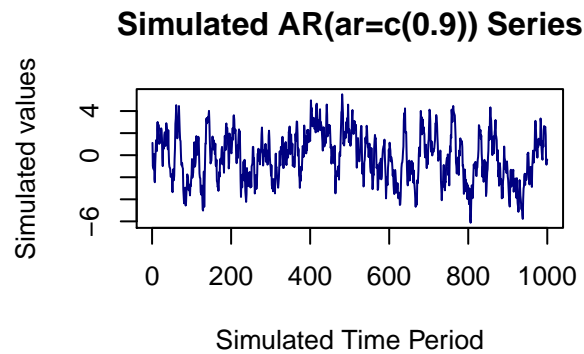
Unsure of comments.

```
# Simulating First series
white.noise.series.1 = rnorm(1000, 0, 1)
series.1 <- white.noise.series.1
for (t in 2:length(white.noise.series.1)) {
  series.1[t] <- 0.9 * series.1[t - 1] + white.noise.series.1[t]
}

# Simulating Second Series
white.noise.series.2 = rnorm(1000, 0, 1)
series.2 <- white.noise.series.2
for (t in 2:length(white.noise.series.2)) {
  series.2[t] <- 0.9 * series.2[t - 1] + white.noise.series.2[t]
}

# Plotting Graphs
par(mfrow = c(2, 2))
plot.ts(series.1, main = "Simulated AR(ar=c(0.9)) Series", col = "navy",
  ylab = "Simulated values", xlab = "Simulated Time Period")
hist(series.1, main = "Simulated AR(ar=c(0.9)) Series", col = "blue", xlab = "Simulated Values")
plot.ts(series.2, main = "Simulated AR(ar=c(0.2)) Series", col = "navy",
```

```
ylab = "Simulated values", xlab = "Simulated Time Period")
hist(series.2, main = "Simulated AR(ar=c(0.2)) Series", col = "blue", xlab = "Simulated Values")
```



Question 5

Unsure of comments.

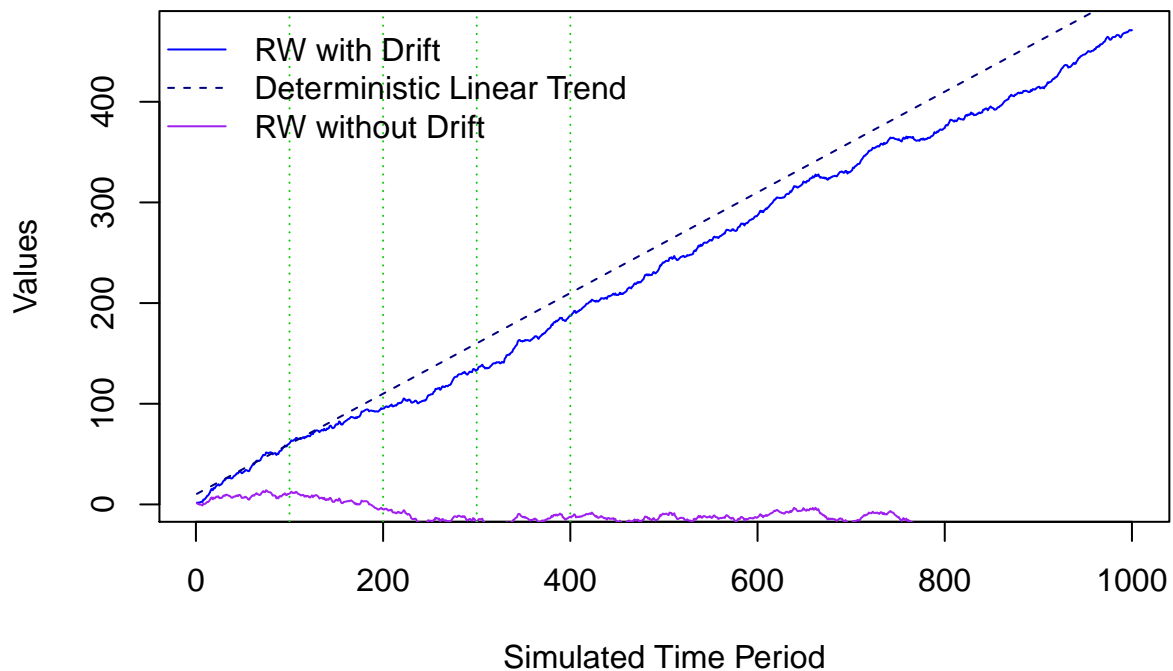
```
white.noise.series.new = rnorm(1000, 0, 1)
r.walk = cumsum(white.noise.series.new)

# Random walk with drift = 0.5
noise.drift = 0.5 + white.noise.series.new
r.walk.drift = cumsum(noise.drift)

par(mfrow = c(1, 1))
plot.ts(r.walk.drift, main = "Random Walk with Drift, Random Walk without Drift, Deterministic Trend",
        col = "blue", ylab = "Values", xlab = "Simulated Time Period", bg = 38)
lines(0.5 * (1:length(r.walk.drift)) + 10, lty = "dashed", col = "navy")
lines(r.walk, col = "purple")
# Add vertical lines
abline(v = c(100, 200, 300, 400), col = 3, lty = 3)
# Add Legend
leg.txt <- c("RW with Drift", "Deterministic Linear Trend", "RW without Drift")
```

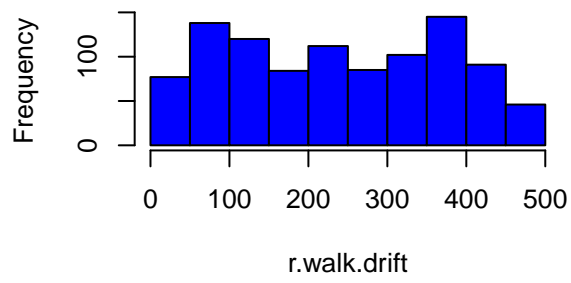
```
legend("topleft", legend = leg.txt, lty = c(1, 2, 1), col = c("blue", "navy",  
  "purple"), bty = "n", cex = 1, merge = TRUE, bg = 336)
```

Random Walk with Drift, Random Walk without Drift, Deterministic Trend

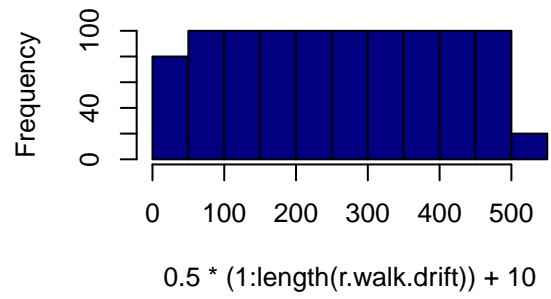


```
par(mfrow = c(2, 2))  
hist(r.walk.drift, main = "RW with Drift", col = "blue")  
hist(0.5 * (1:length(r.walk.drift)) + 10, main = "Deterministic Linear Trend",  
  col = "navy")  
hist(r.walk, main = "RW without Drift", col = "purple")
```

RW with Drift



Deterministic Linear Trend



RW without Drift

