6.1.1 - R: Time Series
Stat 5100: Dr. Bean

Example 1: Bush and the Price of Gas

1. http://www.leftbusinessobserver.com/BushNGas.html

2. "... no occupant of the White House has ever seen his popularity so closely tied to the price of gas."

3. "There's no precedent for this tight relationship."

```
# Load the gas data
```

Example 2: General Electric's gross investment (in millions of dollars) for years $1935 - 1954$.

Originally presented in Grunfeld, Y. (1958), "The Determinants of Corporate Investment," Ph.D. dissertation, University of Chicago; discussed in Boot, J.C.G. (1960), "Investment Demand: An Empirical Contribution to the Aggregation Problem," International Economic Review, 1, 3-30. See also Damodar N. Gujarati, Basic Econometrics, Third Edition, 1995, McGraw-Hill, [1995, pp. 522-525].

```r
# Load the GE data
data(ge)

## Warning in data(ge):  data set 'ge' not found

head(ge)

## Error in head(ge):  object 'ge' not found

# Create a line plot of GE's gross investment each year.
plot(ge$year, ge$GEinv, main = "GE gross investment", xlab = "Year",
     ylab = "GE gross investment (millions)", type = "b", pch = 16)

## Error in plot(ge$year, ge$GEinv, main = "GE gross investment", xlab = "Year", :  object
'ge' not found
```

Make the data stationary

```r
# Create a regression model predicting GE investment from year. Next we will
# examine the residuals (residuals represent the structure after accounting
# for the time dependence)
ge_time_lm <- lm(GEinv ~ year, data = ge)

## Error in is.data.frame(data):  object 'ge' not found

plot(ge$year, ge_time_lm$residuals, xlab = "Year", ylab = "Residual",
     main = "GE gross investment after accounting for time", type = "b", pch = 16)

## Error in plot(ge$year, ge_time_lm$residuals, xlab = "Year", ylab = "Residual", :  object
'ge' not found

# Alternatively, we can make the data stationary after transforming the
# response variable with a log transformation.
ge <- cbind(ge, logGEinv = log(ge$GEinv))

## Error in cbind(ge, logGEinv = log(ge$GEinv)):  object 'ge' not found

ge_time_log_lm <- lm(logGEinv ~ year, data = ge)

## Error in is.data.frame(data):  object 'ge' not found

plot(ge$year, ge_time_log_lm$residuals, xlab = "Year", ylab = "Residual",
     main = "GE gross investment after accounting for time, using log",
     type = "b", pch = 16)

## Error in plot(ge$year, ge_time_log_lm$residuals, xlab = "Year", ylab = "Residual", :  object
'ge' not found
```

Test for independence and investigate potential dependence structures

```r
# Create a time-series object for our data
ge_ts <- ts(ge_time_log_lm$residuals)
```

```
## Error in is.data.frame(data):  object 'ge_time_log_lm' not found
```

```r
# Sample Autocorrelation Plot (ACF) / Sample Partial Autocorrelation Plots (PACF)
par(mfrow = c(2, 1))
acf(ge_ts, lag.max = 12)
```

```
## Error in as.ts(x):  object 'ge_ts' not found
```

```r
pacf(ge_ts, lag.max = 12)
```

```
## Error in pacf(ge_ts, lag.max = 12):  object 'ge_ts' not found
```

```r
par(mfrow = c(1, 1))
```

Fit a dependence structure and assess model adequacy

```r
ge_arima <- arima(ge_ts, order = c(2, 0, 0))
```

```
## Error in NCOL(x):  object 'ge_ts' not found
```

```r
summary(ge_arima)
```

```
## Error in summary(ge_arima):  object 'ge_arima' not found
```

```r
# Create a panel of plots to diagnose the results of the ARIMA predictions
par(mfrow = c(2, 1))
acf(ge_arima$residuals, lag.max = 12)
```

```
## Error in as.ts(x):  object 'ge_arima' not found
```

```r
pacf(ge_arima$residuals, lag.max = 12)
```

```
## Error in pacf(ge_arima$residuals, lag.max = 12):  object 'ge_arima' not found
```

```r
par(mfrow = c(1, 1))
```