Homework 2

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```
data <- read.csv("Data/congress.csv")
attach(data)
library(tseries)
```

```
## Warning: package 'tseries' was built under R version 3.4.4
```

```
library(pander)
```

```
## Warning: package 'pander' was built under R version 3.4.2
```

```
library(forecast)
```

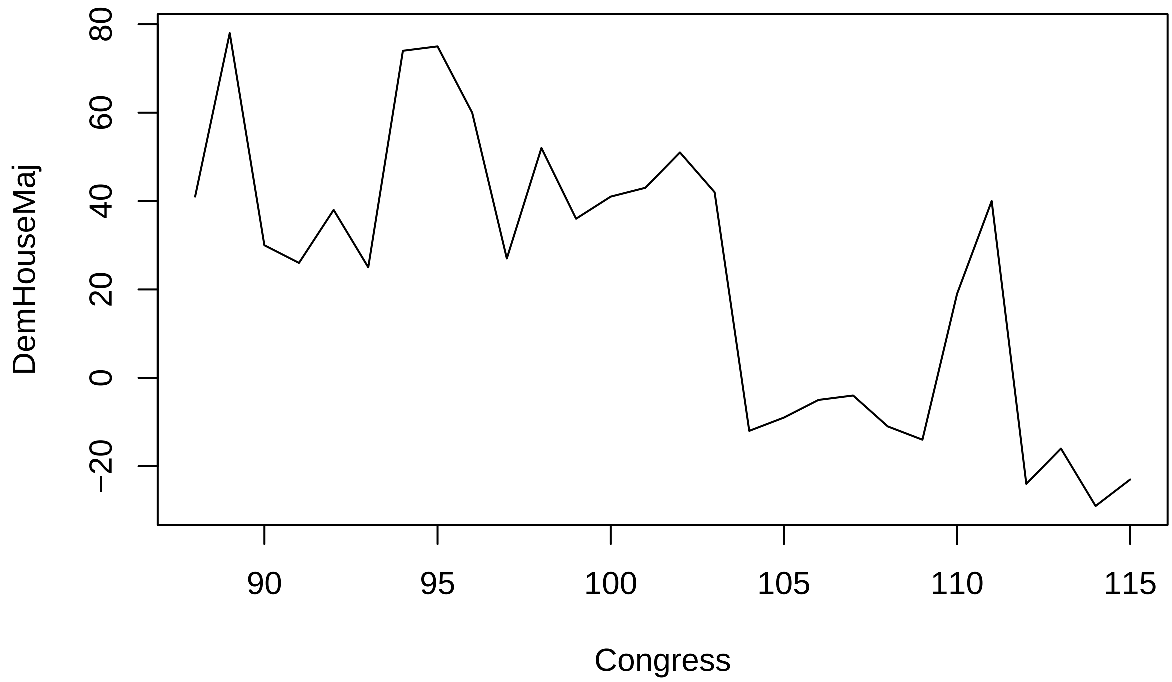
```
## Warning: package 'forecast' was built under R version 3.4.4
```

```
options(digits = 3)
```

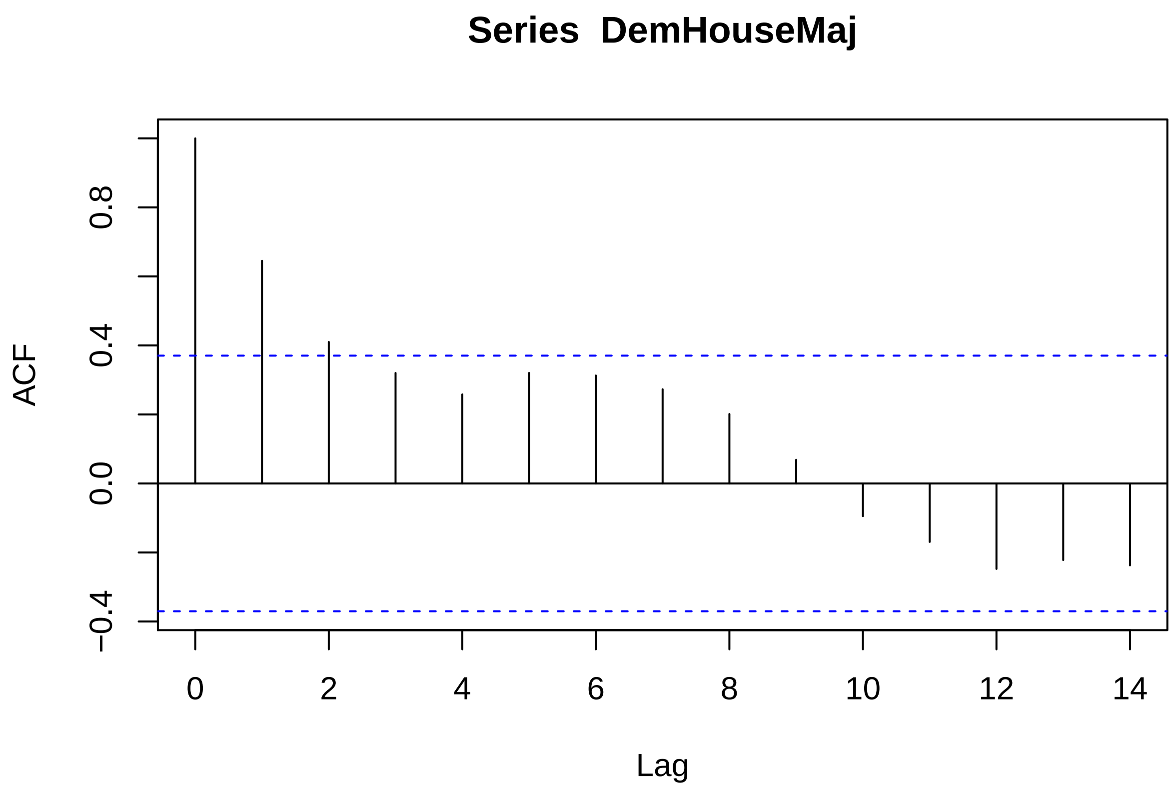
Question 1

Part A

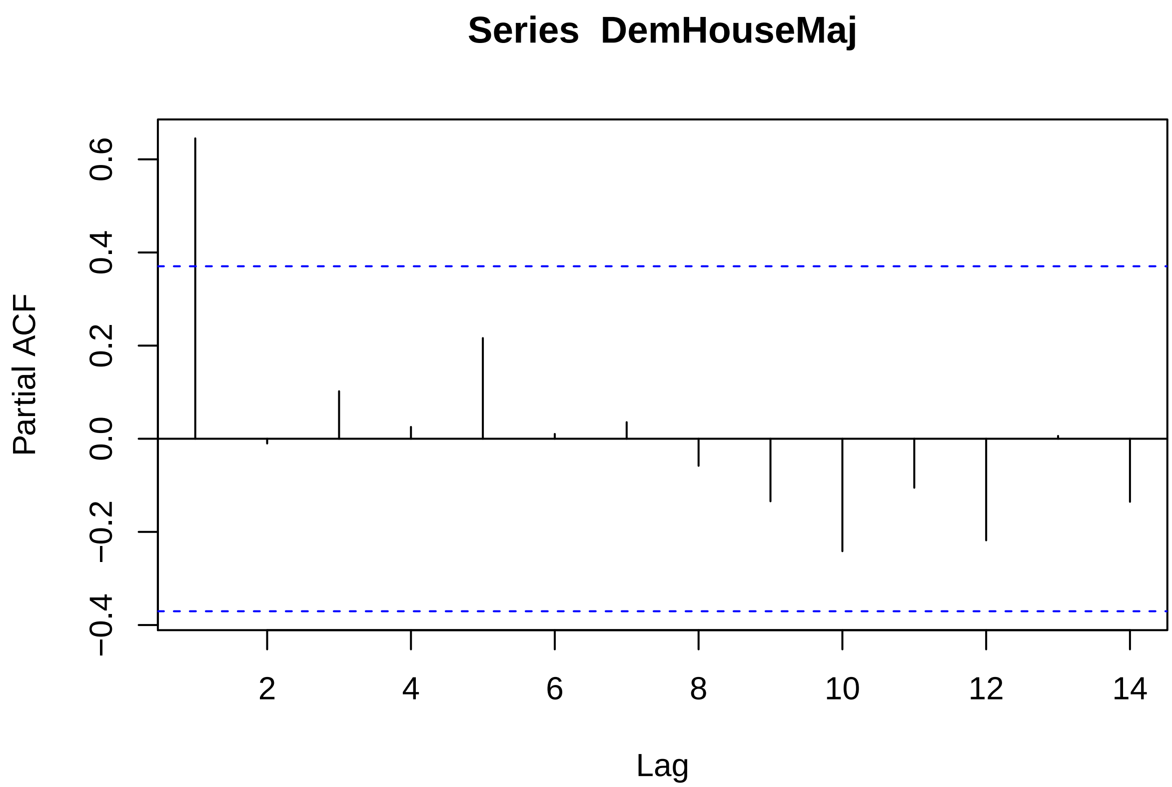
```
plot(Congress, DemHouseMaj, type="l")
```




```
acf(DemHouseMaj)
```




```r
pacf(DemHouseMaj)
```




```r
adf.test(DemHouseMaj)
```

```
##
##  Augmented Dickey-Fuller Test
##
## data:  DemHouseMaj
## Dickey-Fuller = -3, Lag order = 3, p-value = 0.3
## alternative hypothesis: stationary
```

```r
PP.test(DemHouseMaj)
```

```
##
##  Phillips-Perron Unit Root Test
##
## data:  DemHouseMaj
## Dickey-Fuller = -4, Truncation lag parameter = 2, p-value = 0.04
```

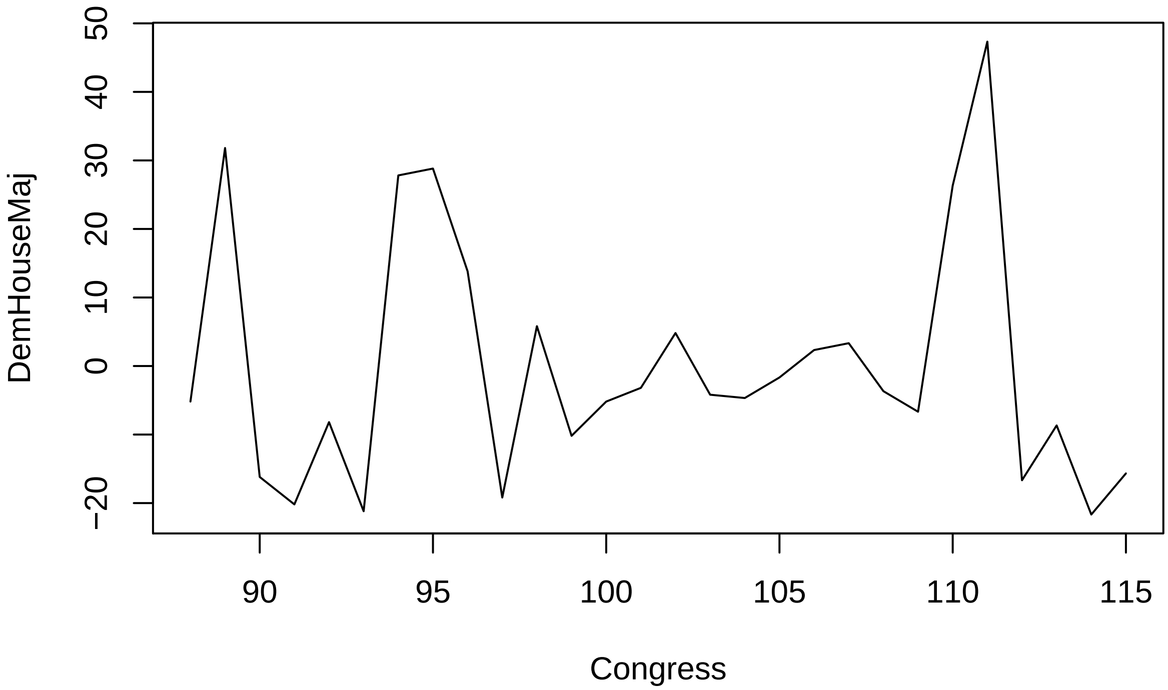
```r
pre1994 <- data[StartYear<1994,]
post1994 <- data[StartYear>1994,]
pre1994$DemHouseMaj <- pre1994$DemHouseMaj - mean(pre1994$DemHouseMaj)
post1994$DemHouseMaj <- post1994$DemHouseMaj - mean(post1994$DemHouseMaj)
new.data <- rbind(pre1994, post1994)

attach(new.data)
```

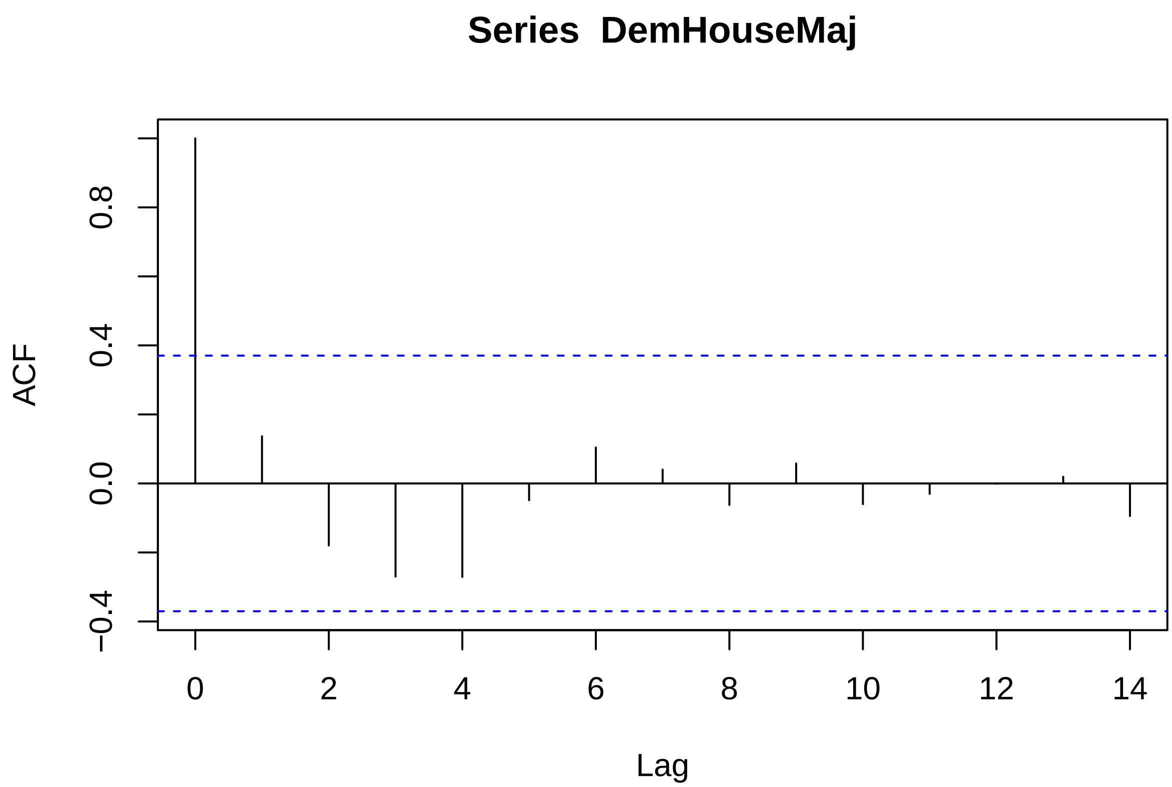
```
## The following objects are masked from data:
##
##     Coattails, Congress, DemHouseMaj, DemHouseSeats, DemPresident,
```

```
##      DemSenateMaj, DemSenateSeats, Midterm, PartisanMidterm,
##      PartisanUnem, Pre1994, StartYear, UemDeviation, Unemployment
```

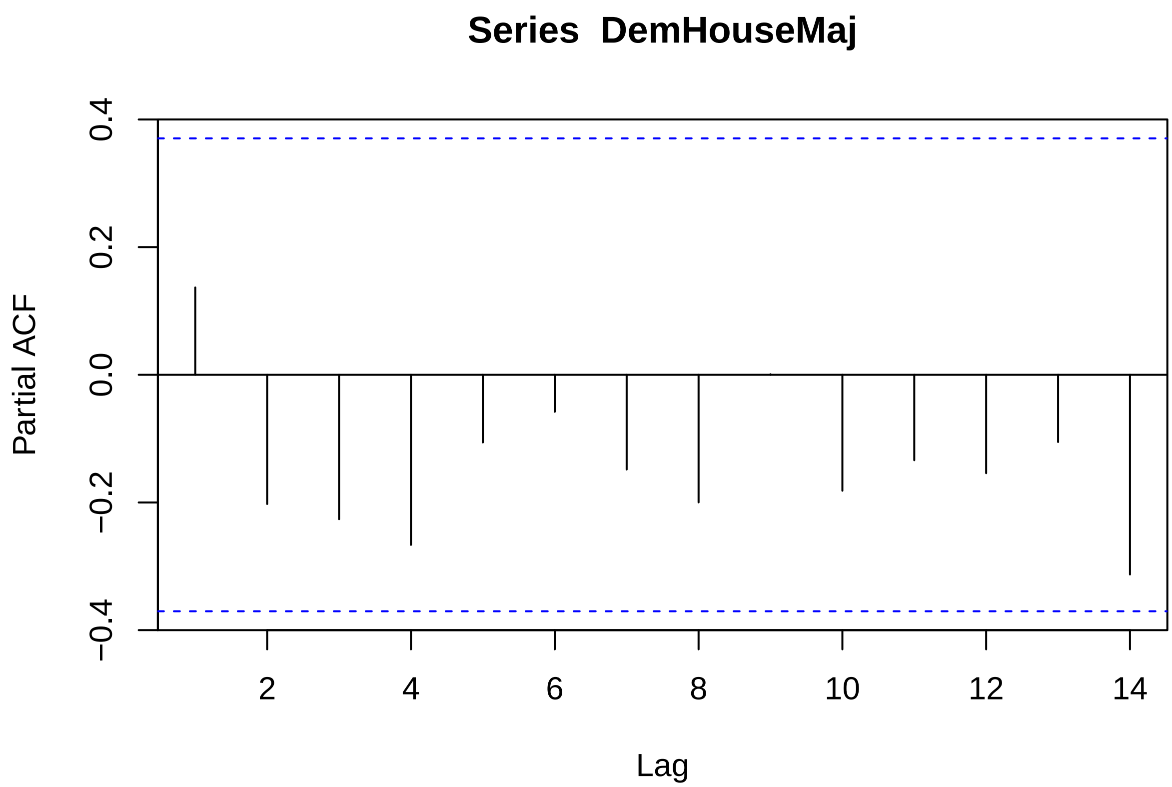
```r
plot(Congress, DemHouseMaj, type="l")
```




```r
acf(DemHouseMaj)
```




```r
pacf(DemHouseMaj)
```



Part B

```r
xcovariates <- cbind(PartisanMidterm, PartisanUnem, Coattails, Pre1994)
ar0 <- arima(DemHouseMaj, order = c(0,0,0),
             xreg = xcovariates, include.mean = TRUE)
```

Table 1: Model Evaluation

Model Components	AIC	$\hat{\sigma}^2$	N	$\hat{\beta}_{PM}$	$\hat{\beta}_{PU}$	$\hat{\beta}_{CT}$	$\hat{\beta}_{1994}$
AR(0)	239.243	195.964	28	-7.27 (3.823)	-2.053 (1.733)	18.396 (5.331)	-5.527 (5.703)

Part C

```r
ar1 <- arima(DemHouseMaj, order = c(1,0,0),
             xreg = xcovariates, include.mean = TRUE)

ar2 <- arima(DemHouseMaj, order = c(2,0,0),
             xreg = xcovariates, include.mean = TRUE)

ma1 <- arima(DemHouseMaj, order = c(0,0,1),
             xreg = xcovariates, include.mean = TRUE)
```

```r
arma11 <- arima(DemHouseMaj, order = c(1,0,1),
        xreg = xcovariates, include.mean = TRUE)
```

Table 2: Model Comparison

Model Components	AIC	$\hat{\sigma}^2$	N	$\hat{\beta}_{PM}$	$\hat{\beta}_{PU}$	$\hat{\beta}_{CT}$	$\hat{\beta}_{1994}$
AR(0)	239.243	195.964	28	-7.27	-2.053	18.396	-5.527
				(3.823)	(1.733)	(5.331)	(5.703)
AR(1)	240.221	188.565	28	-8.848	-2.42	15.364	-6.865
				(3.86)	(1.75)	(5.828)	(7.023)
AR(2)	239.243	169.879	28	-10.726	-2.858	10.279	-8.791
				(3.158)	(1.744)	(5.862)	(6.038)
MA(1)	239.495	183.033	28	-9.866	-2.761	13.121	-8.135
				(3.743)	(1.841)	(6.315)	(7.58)
ARMA(1,1)	238.096	148.58	28	-11.673	4.575	14.522	-10.634
				(3.204)	(1.484)	(6.058)	(6.623)

Part D

```r
ar0.cv <- arimaCV(DemHouseMaj, order = c(0,0,0), forward=3,
             xreg=xcovariates, include.mean = TRUE, minper = 20)

ar1.cv <- arimaCV(DemHouseMaj, order = c(1,0,0), forward=3,
             xreg=xcovariates, include.mean = TRUE, minper = 20)

ar2.cv <- arimaCV(DemHouseMaj, order = c(2,0,0), forward=3,
             xreg=xcovariates, include.mean = TRUE, minper = 20)

ma1.cv <- arimaCV(DemHouseMaj, order = c(0,0,1), forward=3,
             xreg=xcovariates, include.mean = TRUE, minper = 20)

arma11.cv <- arimaCV(DemHouseMaj, order = c(1,0,1), forward=3,
             xreg=xcovariates, include.mean = TRUE, minper = 20)
```

Table 3: Model Comparison

Model Components	AIC	RMSE	MAE_1	MAE_2	MAE_3	Average MAE
AR(0)	239.243	195.964	15.412	17.528	17.216	16.719
AR(1)	240.221	188.565	15.94	20.156	17.424	17.84
AR(2)	239.662	169.879	17.512	16.266	16.728	16.835
MA(1)	239.495	183.033	14.949	20.338	19.242	18.176
ARMA(1,1)	238.096	148.58	16.64	21.86	18.536	19.012