

# ballot

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ballot

references:

- Cannon, et al., Stat2, chapter 01, example 1.9
- [ballot, Wikipedia](#)
- [butterfly ballot, Wikipedia](#)

Import the data.

```
data <- read.csv("PalmBeach.csv", header=TRUE)
head(data, 4)
```

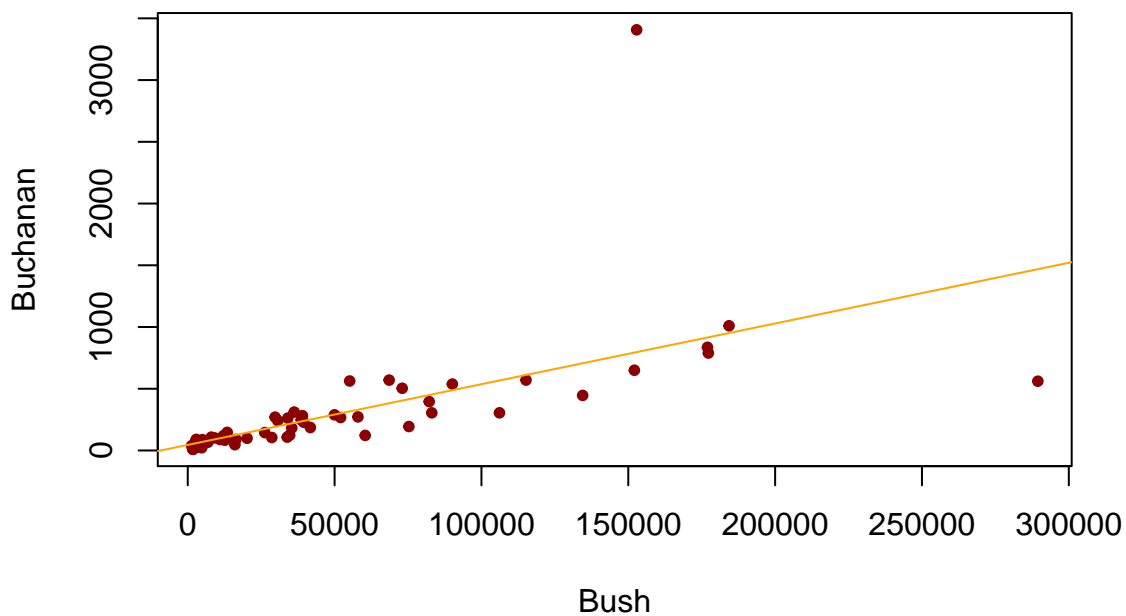
```
##      County Buchanan  Bush
## 1  ALACHUA      262 34062
## 2   BAKER       73  5610
## 3    BAY       248 38637
## 4 BRADFORD      65  5413
```

```
dim(data)
```

```
## [1] 67  3
```

View the data.

```
plot(Buchanan ~ Bush, data=data,
     pch=20, col="darkred")
ballot.lm <- lm(Buchanan ~ Bush, data=data)
abline(ballot.lm, col="orange")
```



Linear model.

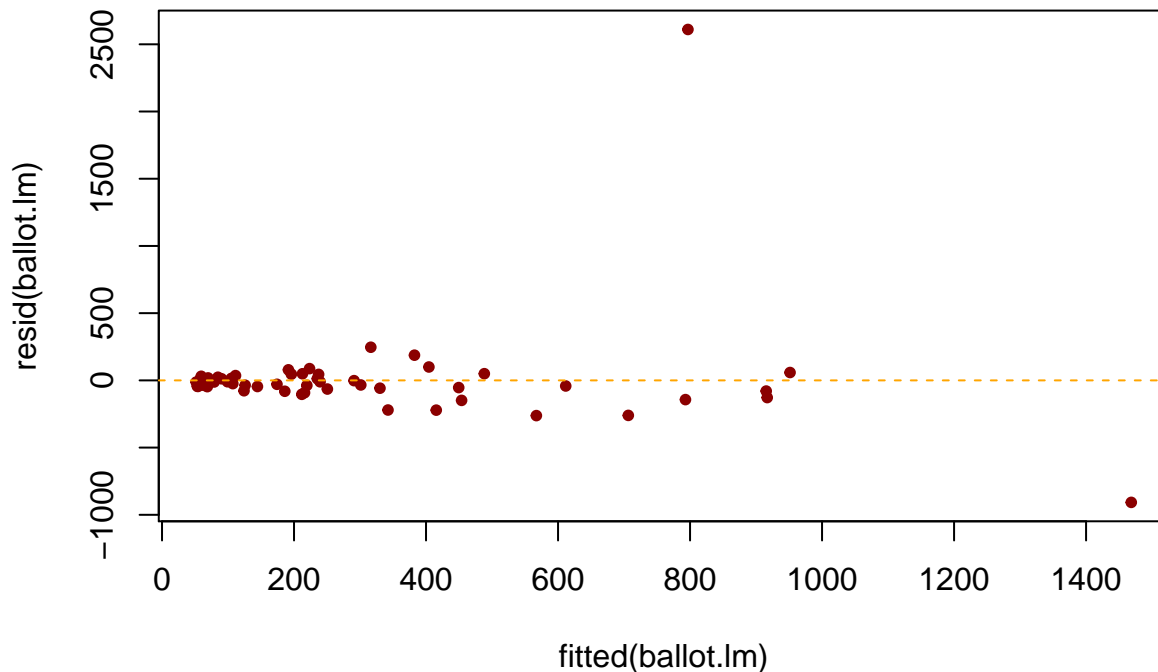
$$\widehat{Buchanan} = 45.29 + 0.005 \text{ Bush}$$

```
options(show.signif.stars=FALSE)
summary(ballot.lm)
```

```
##
## Call:
## lm(formula = Buchanan ~ Bush, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -907.50  -46.10  -29.19   12.26 2610.19
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 4.529e+01  5.448e+01  0.831   0.409
## Bush        4.917e-03  7.644e-04  6.432 1.73e-08
##
## Residual standard error: 353.9 on 65 degrees of freedom
## Multiple R-squared:  0.3889, Adjusted R-squared:  0.3795
## F-statistic: 41.37 on 1 and 65 DF,  p-value: 1.727e-08
```

Residuals.

```
plot(fitted(ballot.lm), resid(ballot.lm),
     pch=20, col="darkred")
abline(h=0, col="orange", lty="dashed")
```

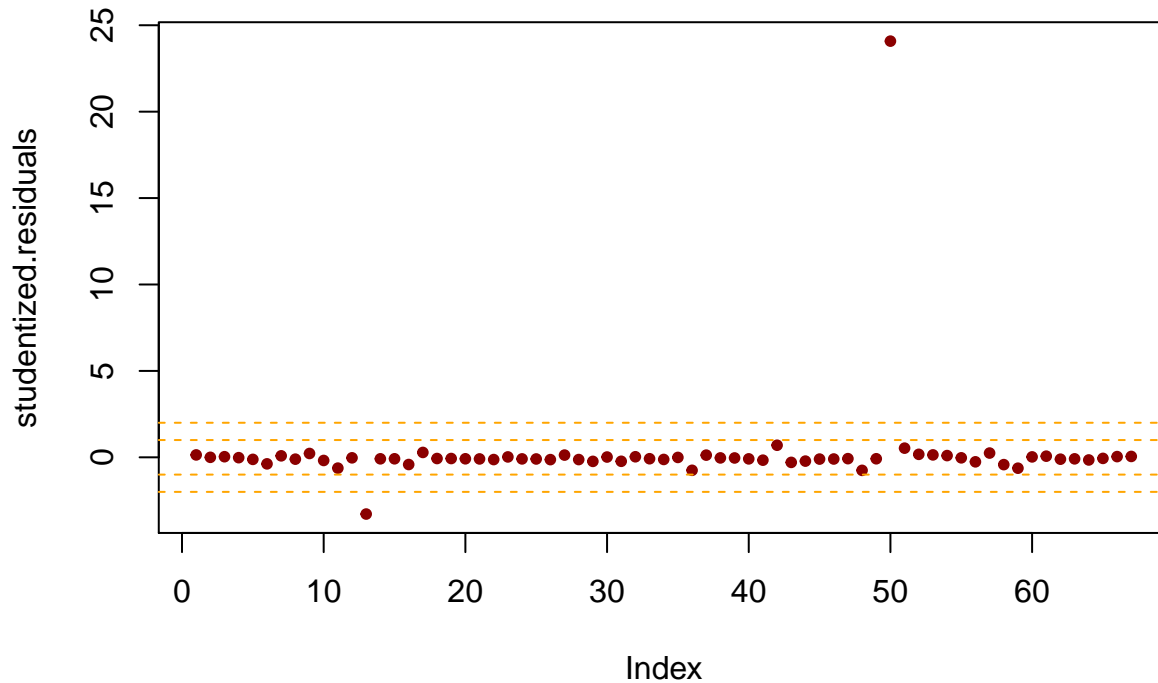


Studentized residuals.

```
studentized.residuals <- rstudent(ballot.lm)
studentized.residuals[50] # Palm Beach
```

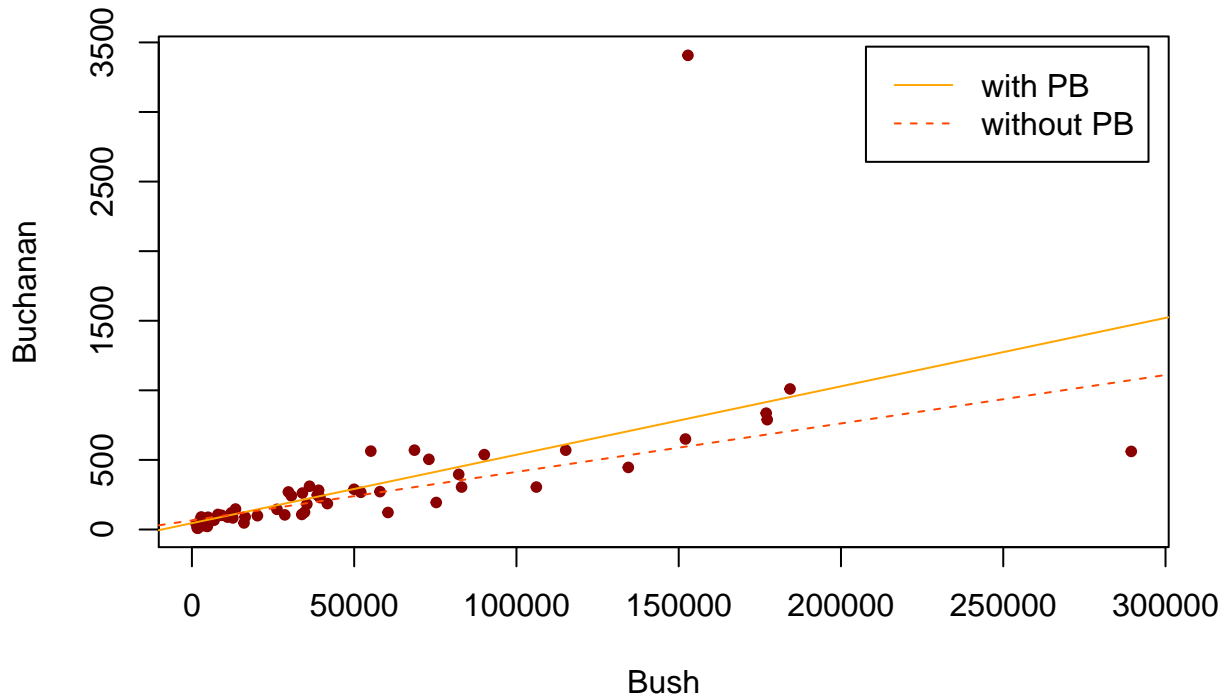
```
##      50
## 24.08014
```

```
plot(studentized.residuals,
      pch=20, col="darkred")
abline(h=c(2, 1, -1, -2), col="orange", lty="dashed")
```



Remove Palm Beach and refit the data.

```
data.withoutPB <- data[data$County!="PALM BEACH", ]
plot(Buchanan ~ Bush, data=data,
      pch=20, col="darkred")
abline(ballot.lm, col="orange")
ballot.lm2 <- lm(Buchanan ~ Bush, data=data.withoutPB)
abline(ballot.lm2, col="orangered", lty=2)
legend(x="topright", legend=c("with PB", "without PB"),
       lty=1:2, col=c("orange", "orangered"), inset=0.02)
```



```
summary(ballot.lm2)
```

```
##
## Call:
## lm(formula = Buchanan ~ Bush, data = data.withoutPB)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -512.43  -47.97  -17.09   41.78  305.45
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 6.557e+01  1.733e+01   3.784 0.000343
## Bush        3.482e-03  2.501e-04  13.923 < 2e-16
##
## Residual standard error: 112.5 on 64 degrees of freedom
## Multiple R-squared:  0.7518, Adjusted R-squared:  0.7479
## F-statistic: 193.8 on 1 and 64 DF,  p-value: < 2.2e-16
```

Linear model with Palm Beach.

$$\widehat{Buchanan} = 45.29 + 0.005 \text{ Bush}$$

Linear model without Palm Beach.

$$\widehat{Buchanan} = 65.573 + 0.003 \text{ Bush}$$