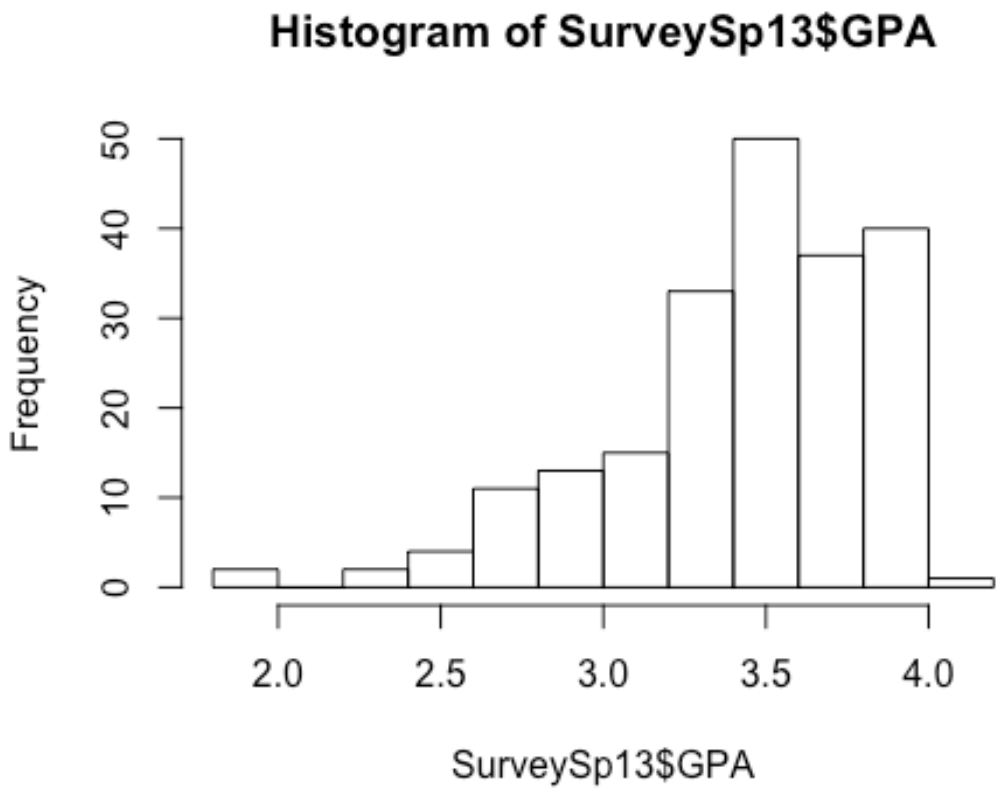
Lab10.R

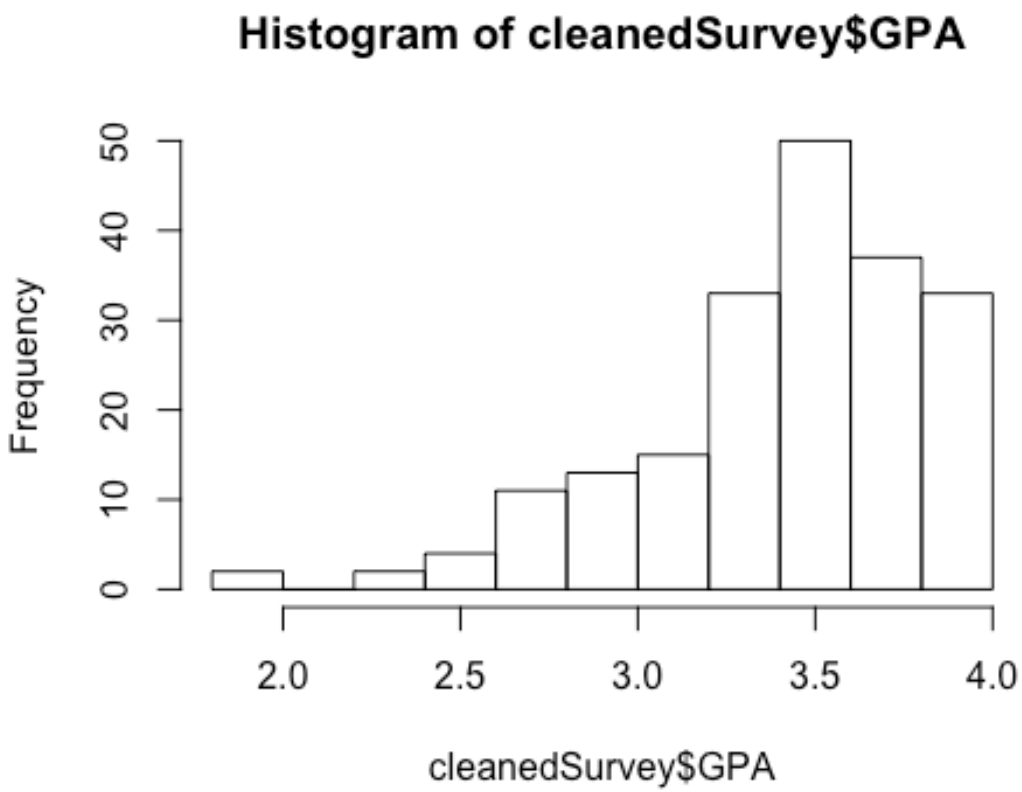
riserate

Thu Apr 13 16:00:45 2017

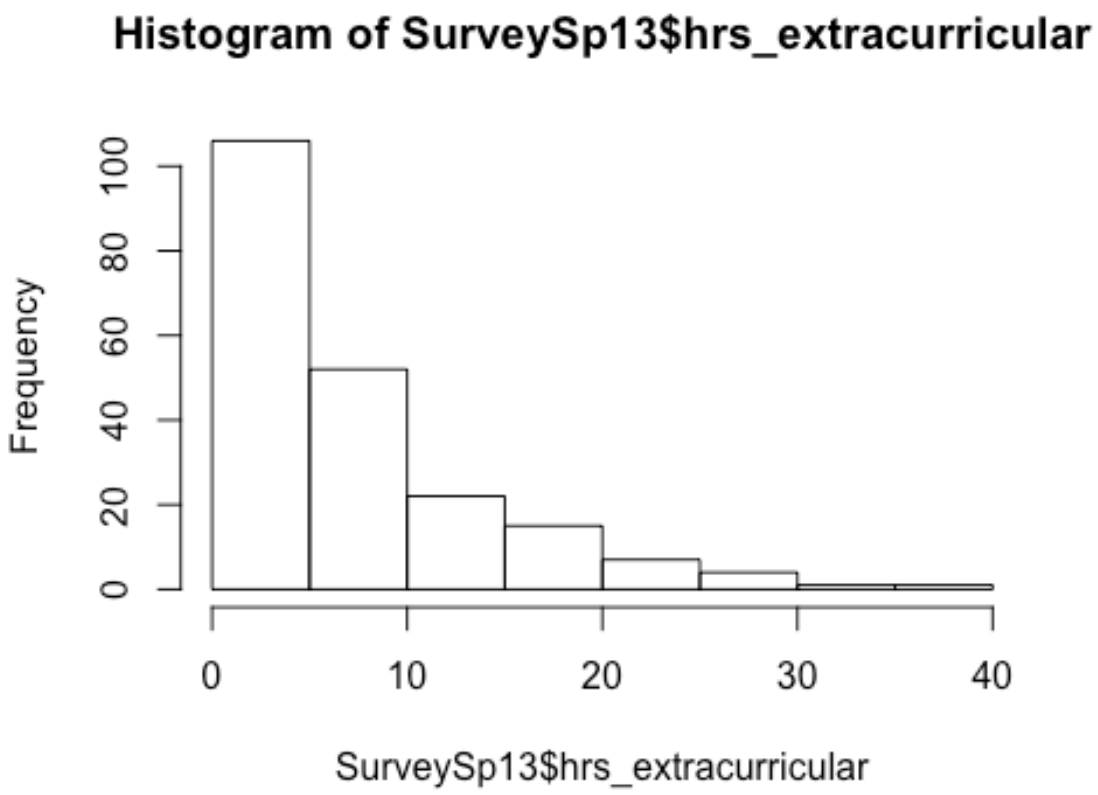
```
# Lab 10

#Import the data into RStudio
SurveySp13 <- read.csv("SurveySp13.csv", header = TRUE)

#1(a)
# Use a histogram to see the distrbution.
# The GPA is left skewed
hist(SurveySp13$GPA)
```



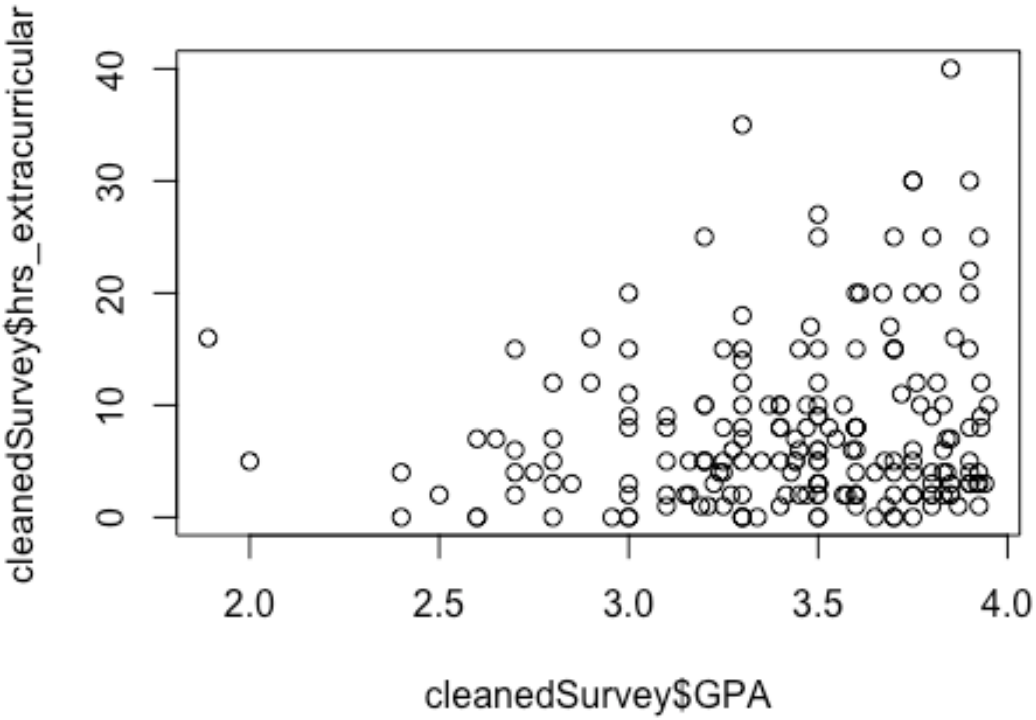

```
#1(b)
#Creating a clean set due to some GPA's being higher than 4.0
cleanedSurvey <-subset(SurveySp13,SurveySp13$GPA<4.0)
hist(cleanedSurvey$GPA)
```




```
#Data contains 200 observations.

#2(a)
#Plotting histogram for hrs extracurriculars
hist(SurveySp13$hrs_extracurricular)
```




```
#Data is right skewed.

#2(b)
#Plotting a scatter plot to show the relationship between hrs extracurricular
and GPA
plot(cleanedSurvey$GPA,cleanedSurvey$hrs_extracurricular)
```




```
#The scatter plot showed that there may be a slight positive correlation.
Higher GPAs have more extracurricular involvement.

#2(c)
#Finding correation between hrs extracurricular and GPA
cor(cleanedSurvey$GPA,cleanedSurvey$hrs_extracurricular)

## [1] 0.1459643

cor.test(cleanedSurvey$GPA,cleanedSurvey$hrs_extracurricular)

##
##  Pearson's product-moment correlation
##
## data:  cleanedSurvey$GPA and cleanedSurvey$hrs_extracurricular
## t = 2.0761, df = 198, p-value = 0.03917
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.007372618 0.279054151
## sample estimates:
##       cor
## 0.1459643
```

```r
#The correlation is 0.1459643. This is a weak positive correlation.
#The 95% confidence interval is (0.007372618, 0.279054151) and does not
include
#zero, which means the null hypothesis (p=0) is rejected.

#3(a)
#Estimating regression model
model1<-lm(cleanedSurvey$hrs_extracurricular~cleanedSurvey$GPA)
summary(model1)
```

```
##
## Call:
## lm(formula = cleanedSurvey$hrs_extracurricular ~ cleanedSurvey$GPA)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -8.575 -5.459 -1.999  2.482 31.149
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)          -1.792      4.601  -0.389   0.6974
## cleanedSurvey$GPA     2.764      1.331   2.076   0.0392 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.303 on 198 degrees of freedom
## Multiple R-squared:  0.02131,    Adjusted R-squared:  0.01636
## F-statistic:  4.31 on 1 and 198 DF,  p-value: 0.03917
```

```r
#viewing regressing results ŷ = -1.792 + 2.764GPA

#3(b)
#Get confidence interval for intercept and slope
confint(model1)
```

```
##                          2.5 %   97.5 %
## (Intercept)       -10.8649885 7.281313
## cleanedSurvey$GPA   0.1386326 5.390075
```

```r
#The confidence interval for the intercept is (-10.8649885, 7.281313)
#The intercept is not significantly different than zero since the p-value >
0.05 also since the confidence interval includes 0

#3(c)
#Get confidence interval for intercept and slope.
confint(model1)
```

```
##                          2.5 %   97.5 %
## (Intercept)       -10.8649885 7.281313
## cleanedSurvey$GPA   0.1386326 5.390075
```

```
#The confidence interval for the slope is (0.1386326, 5.390075).
#Since it does not include 0 we can conclude the slope is significantly
different (greater than) 0

#3(d)
#The R 2 of the model is 0.02131.
#This is quite low and so the association between hrs extrscurricula and GPA
is rickety.

#3(e)
#The residual standard error is 7.303 on 198 degrees of freedom. It is
moderately high.

#4(a)
#Checking model assumptions using residual plots
model1$residuals
```

```
##           1           2           3           4           5           6
## 10.66946972 -7.33053028 -7.44110444 -6.71270723 15.94174853  0.66946972
##           7           8           9          10          11          12
## -7.90621200 -1.07207323 -2.05409489 11.84016355  1.26312979 -6.71270723
##          13          14          15          16          17          18
## 21.42551047 -4.43627184 -4.88340106 -4.71270723 13.49877589 -5.71270723
##          19          20          21          22          23          24
## -2.19231259 27.66946972  0.32808206  7.80768741 -5.88340106 -1.67191794
##          25          26          27          28          29          30
## -6.50122411 -6.04442970 -1.88340106 -5.39548255  0.39303433  9.32808206
##          31          32          33          34          35          36
##  6.66946972 -1.26142143  2.11659894 -8.43627184 -1.74518336 16.56372816
##          37          38          39          40          41          42
## -6.05825147 -4.88340106 12.56720871 -1.82328138  9.17188602 -4.15983645
##          43          44          45          46          47          48
## -3.43627184 11.64665878 -6.09971677 -6.37959254 -5.24759966 -2.60696567
##          49          50          51          52          53          54
## -6.57448953 -6.19231259 -3.57448953 -0.15983645 -1.01332569  4.66946972
##          55          56          57          58          59          60
## -3.19231259 -5.80047044 -6.08173843  5.77521128 -3.67191794 -2.15983645
##          61          62          63          64          65          66
## -6.15983645  2.22234050  0.39303433 -3.16466905 -0.15983645 17.11659894
##          67          68          69          70          71          72
## -6.57448953  1.60451745 -5.39548255 -4.12320374 -2.94835333 -5.98914262
##          73          74          75          76          77          78
## -6.15983645 -2.57448953 -6.06861277  2.94590511 21.42551047 -6.85092492
##          79          80          81          82          83          84
## -4.82328138 13.01085738 -5.85092492 -6.60696567  0.03643268  6.56372816
##          85          86          87          88          89          90
##  2.50844108 -7.33053028 19.11659894  1.37022339 -0.98914262 -6.15983645
##          91          92          93          94          95          96
## -2.71753983  6.84016355 -4.50122411 -8.29805414 -4.88340106 -4.88340106
##          97          98          99         100         101         102
```

```
## 11.42551047  1.49877589 -6.85092492 -0.71753983 -4.77765950  7.11659894
##         103         104         105         106         107         108
## -2.88340106  2.49877589 -2.88340106 -4.57448953  3.24859182  1.11659894
##         109         110         111         112         113         114
##  1.11659894  6.01638609 -7.88340106 -5.64843098  2.66946972 -1.81013564
##         115         116         117         118         119         120
## -6.79563785 -3.50122411  6.56372816 17.94590511  0.80768741  1.05164667
##         121         122         123         124         125         126
## -2.71753983 11.01085738  2.39303433 -0.15983645  9.77521128 -3.36716299
##         127         128         129         130         131         132
## -6.50122411  2.19952956 -4.91587720 -7.88340106  7.12143154 -2.46874797
##         133         134         135         136         137         138
## -2.05409489  4.49877589 -3.11904716 11.28729277 -5.33053028 -7.38098476
##         139         140         141         142         143         144
## -4.79563785 -8.43627184  1.20436215  0.28729277  2.94590511  6.05164667
##         145         146         147         148         149         150
## -3.98914262 -3.68713193 -0.33053028  4.11659894 16.28729277 -6.57448953
##         151         152         153         154         155         156
##  8.59137170 -5.94835333 -6.02645135 -1.85092492 -6.43627184  0.19952956
##         157         158         159         160         161         162
## -2.05409489 -1.88340106  6.56372816  0.87263969 -2.33053028  0.39303433
##         163         164         165         166         167         168
## -4.29805414  1.46629975  2.92792677 -1.77765950 -5.88340106 -1.94352073
##         169         170         171         172         173         174
## 11.81252001 -4.94352073 21.01085738 -4.84261177  7.66946972  1.22234050
##         175         176         177         178         179         180
##  8.49877589 -8.57448953 -0.84261177 -0.15983645 -8.05825147 -4.98914262
##         181         182         183         184         185         186
##  1.93138723 -5.05548711 -5.74518336 -2.13219291  7.25481664 31.14907508
##         187         188         189         190         191         192
## -7.71270723 -5.77765950 -2.79563785 -0.07207323 -0.94835333 -7.15983645
##         193         194         195         196         197         198
##  2.47596495 -5.98914262 -6.09072760 -3.08657103 -7.33053028  2.39303433
##         199         200
##  3.39786693 -0.15983645
```

```
#regular residuals
resid(model1)
```

```
##           1           2           3           4           5           6
## 10.66946972 -7.33053028 -7.44110444 -6.71270723 15.94174853  0.66946972
##           7           8           9          10          11          12
## -7.90621200 -1.07207323 -2.05409489 11.84016355  1.26312979 -6.71270723
##          13          14          15          16          17          18
## 21.42551047 -4.43627184 -4.88340106 -4.71270723 13.49877589 -5.71270723
##          19          20          21          22          23          24
## -2.19231259 27.66946972  0.32808206  7.80768741 -5.88340106 -1.67191794
##          25          26          27          28          29          30
## -6.50122411 -6.04442970 -1.88340106 -5.39548255  0.39303433  9.32808206
##          31          32          33          34          35          36
```

```
##  6.66946972 -1.26142143  2.11659894 -8.43627184 -1.74518336 16.56372816
##          37          38          39          40          41          42
## -6.05825147 -4.88340106 12.56720871 -1.82328138  9.17188602 -4.15983645
##          43          44          45          46          47          48
## -3.43627184 11.64665878 -6.09971677 -6.37959254 -5.24759966 -2.60696567
##          49          50          51          52          53          54
## -6.57448953 -6.19231259 -3.57448953 -0.15983645 -1.01332569  4.66946972
##          55          56          57          58          59          60
## -3.19231259 -5.80047044 -6.08173843  5.77521128 -3.67191794 -2.15983645
##          61          62          63          64          65          66
## -6.15983645  2.22234050  0.39303433 -3.16466905 -0.15983645 17.11659894
##          67          68          69          70          71          72
## -6.57448953  1.60451745 -5.39548255 -4.12320374 -2.94835333 -5.98914262
##          73          74          75          76          77          78
## -6.15983645 -2.57448953 -6.06861277  2.94590511 21.42551047 -6.85092492
##          79          80          81          82          83          84
## -4.82328138 13.01085738 -5.85092492 -6.60696567  0.03643268  6.56372816
##          85          86          87          88          89          90
##  2.50844108 -7.33053028 19.11659894  1.37022339 -0.98914262 -6.15983645
##          91          92          93          94          95          96
## -2.71753983  6.84016355 -4.50122411 -8.29805414 -4.88340106 -4.88340106
##          97          98          99         100         101         102
## 11.42551047  1.49877589 -6.85092492 -0.71753983 -4.77765950  7.11659894
##         103         104         105         106         107         108
## -2.88340106  2.49877589 -2.88340106 -4.57448953  3.24859182  1.11659894
##         109         110         111         112         113         114
##  1.11659894  6.01638609 -7.88340106 -5.64843098  2.66946972 -1.81013564
##         115         116         117         118         119         120
## -6.79563785 -3.50122411  6.56372816 17.94590511  0.80768741  1.05164667
##         121         122         123         124         125         126
## -2.71753983 11.01085738  2.39303433 -0.15983645  9.77521128 -3.36716299
##         127         128         129         130         131         132
## -6.50122411  2.19952956 -4.91587720 -7.88340106  7.12143154 -2.46874797
##         133         134         135         136         137         138
## -2.05409489  4.49877589 -3.11904716 11.28729277 -5.33053028 -7.38098476
##         139         140         141         142         143         144
## -4.79563785 -8.43627184  1.20436215  0.28729277  2.94590511  6.05164667
##         145         146         147         148         149         150
## -3.98914262 -3.68713193 -0.33053028  4.11659894 16.28729277 -6.57448953
##         151         152         153         154         155         156
##  8.59137170 -5.94835333 -6.02645135 -1.85092492 -6.43627184  0.19952956
##         157         158         159         160         161         162
## -2.05409489 -1.88340106  6.56372816  0.87263969 -2.33053028  0.39303433
##         163         164         165         166         167         168
## -4.29805414  1.46629975  2.92792677 -1.77765950 -5.88340106 -1.94352073
##         169         170         171         172         173         174
## 11.81252001 -4.94352073 21.01085738 -4.84261177  7.66946972  1.22234050
##         175         176         177         178         179         180
##  8.49877589 -8.57448953 -0.84261177 -0.15983645 -8.05825147 -4.98914262
##         181         182         183         184         185         186
```

```
##  1.93138723 -5.05548711 -5.74518336 -2.13219291  7.25481664 31.14907508
##         187         188         189         190         191         192
## -7.71270723 -5.77765950 -2.79563785 -0.07207323 -0.94835333 -7.15983645
##         193         194         195         196         197         198
##  2.47596495 -5.98914262 -6.09072760 -3.08657103 -7.33053028  2.39303433
##         199         200
##  3.39786693 -0.15983645
```

```
#regular residuals
rstandard(model1)
```

```
##            1            2            3            4            5
##  1.465072924 -1.006588116 -1.021616309 -0.923549719  2.197258725
##            6            7            8            9           10
##  0.091927901 -1.088781836 -0.147776650 -0.282230337  1.626092725
##           11           12           13           14           15
##  0.179672623 -0.923549719  2.946084187 -0.609705574 -0.670410958
##           16           17           18           19           20
## -0.648385114  1.858872972 -0.785967416 -0.301116170  3.799419461
##           21           22           23           24           25
##  0.045447447  1.072393120 -0.807694575 -0.231601819 -0.895262644
##           26           27           28           29           30
## -0.833038025 -0.258560109 -0.749407806  0.053954228  1.292169143
##           31           32           33           34           35
##  0.915814915 -0.173232616  0.290574357 -1.159451484 -0.239568537
##           36           37           38           39           40
##  2.276460451 -0.835011659 -0.670410958  1.798203704 -0.250981446
##           41           42           43           44           45
##  1.259102275 -0.571299523 -0.472269097  1.600271729 -0.840938796
##           46           47           48           49           50
## -0.879105890 -0.720678980 -0.357874131 -0.904015785 -0.850519887
##           51           52           53           54           55
## -0.491505073 -0.021951461 -0.139132648  0.641185910 -0.438467099
##           56           57           58           59           60
## -0.796268579 -0.835560107  0.796582055 -0.508651085 -0.296625492
##           61           62           63           64           65
## -0.845973554  0.305637394  0.053954228 -0.434697663 -0.021951461
##           66           67           68           69           70
##  2.349828605 -0.904015785  0.222860122 -0.749407806 -0.566418772
##           71           72           73           74           75
## -0.407472974 -0.825153734 -0.845973554 -0.354001503 -0.833307389
##           76           77           78           79           80
##  0.404764063  2.946084187 -0.943185570 -0.663942573  1.792570028
##           81           82           83           84           85
## -0.805512835 -0.906978609  0.005002002  0.902095677  0.344815131
##           86           87           88           89           90
## -1.006588116  2.624395838  0.188451843 -0.136279060 -0.845973554
##           91           92           93           94           95
## -0.373046515  0.939407647 -0.619849082 -1.139994753 -0.670410958
##           96           97           98           99          100
```

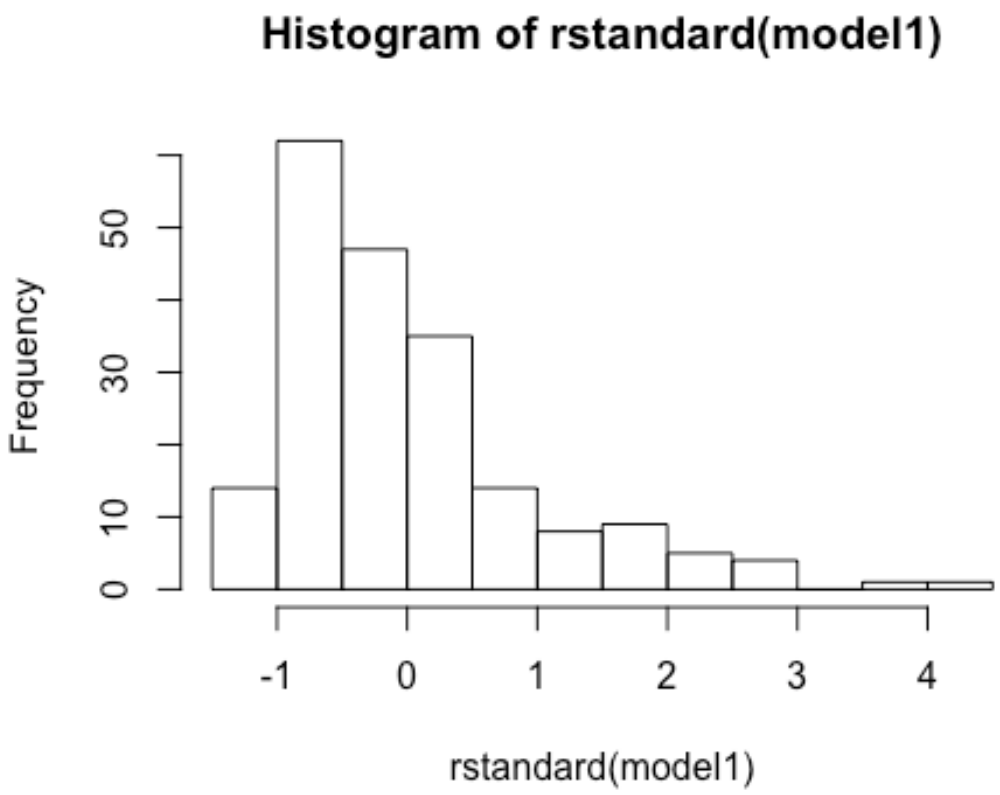
```
## -0.670410958  1.571048483  0.206391603 -0.943185570 -0.098499285
##          101          102          103          104          105
## -0.657069158  0.976992440 -0.395843725  0.344098384 -0.395843725
##          106          107          108          109          110
## -0.629008644  0.447027161  0.153290741  0.153290741  0.828881241
##          111          112          113          114          115
## -1.082261808 -0.775384523  0.366556906 -0.250446666 -0.935318661
##          116          117          118          119          120
## -0.482142301  0.902095677  2.465747262  0.110936617  0.145341330
##          121          122          123          124          125
## -0.373046515  1.517020158  0.328506467 -0.021951461  1.348307017
##          126          127          128          129          130
## -0.462672706 -0.895262644  0.301943832 -0.675728570 -1.082261808
##          131          132          133          134          135
##  0.980565796 -0.338933353 -0.282230337  0.619511945 -0.434536641
##          136          137          138          139          140
##  1.552931734 -0.731959112 -1.014242429 -0.660048353 -1.159451484
##          141          142          143          144          145
##  0.165762571  0.039526401  0.404764063  0.836359211 -0.549603864
##          146          147          148          149          150
## -0.506145771 -0.045386601  0.565141590  2.240843248 -0.904015785
##          151          152          153          154          155
##  1.180664539 -0.822083703 -0.828093813 -0.254821896 -0.884578529
##          156          157          158          159          160
##  0.027390730 -0.282230337 -0.258560109  0.902095677  0.120327398
##          161          162          163          164          165
## -0.320015605  0.053954228 -0.590470861  0.203381260  0.403591093
##          166          167          168          169          170
## -0.244480636 -0.807694575 -0.267128300  1.622389202 -0.679464986
##          171          172          173          174          175
##  2.894769506 -0.676953900  1.053129417  0.168107887  1.170339068
##          176          177          178          179          180
## -1.179022925 -0.117789605 -0.021951461 -1.110672603 -0.687378799
##          181          182          183          184          185
##  0.265207109 -0.696788656 -0.788665076 -0.292813213  0.995898678
##          186          187          188          189          190
##  4.288378351 -1.061132022 -0.794598666 -0.384778045 -0.009934714
##          191          192          193          194          195
## -0.131065822 -0.983310569  0.339907436 -0.825153734 -0.836374792
##          196          197          198          199          200
## -0.426136239 -1.006588116  0.328506467  0.467269169 -0.021951461
```

```
#regular residuals
predict(model1)
```

```
##        1        2        3        4        5        6        7        8
## 7.330530 7.330530 7.441104 8.712707 9.058251 7.330530 8.906212 9.072073
##        9       10       11       12       13       14       15       16
## 7.054095 8.159836 3.736870 8.712707 8.574490 8.436272 7.883401 8.712707
##       17       18       19       20       21       22       23       24
```

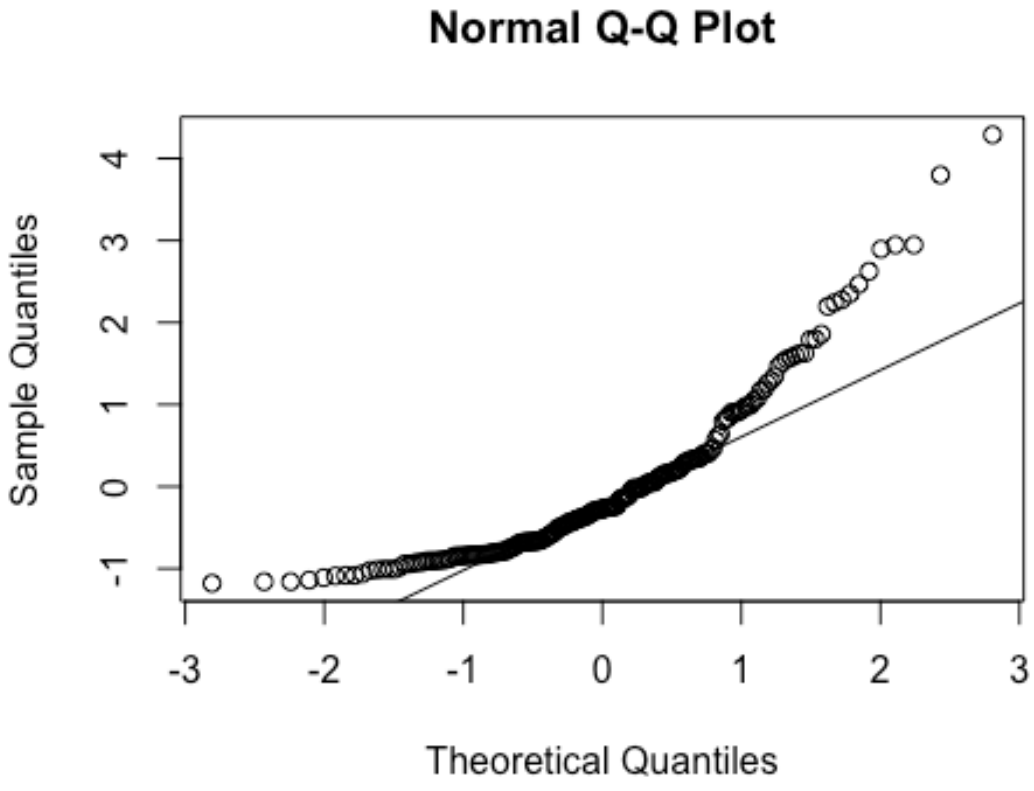
```
## 6.501224 8.712707 7.192313 7.330530 5.671918 7.192313 7.883401 5.671918
##       25       26       27       28       29       30       31       32
## 6.501224 9.044430 7.883401 5.395483 7.606966 5.671918 7.330530 7.261421
##       33       34       35       36       37       38       39       40
## 7.883401 8.436272 7.745183 8.436272 9.058251 7.883401 3.432791 8.823281
##       41       42       43       44       45       46       47       48
## 7.828114 8.159836 8.436272 8.353341 9.099717 6.379593 7.247600 7.606966
##       49       50       51       52       53       54       55       56
## 8.574490 7.192313 8.574490 8.159836 8.013326 7.330530 7.192313 7.800470
##       57       58       59       60       61       62       63       64
## 7.081738 6.224789 5.671918 8.159836 8.159836 6.777660 7.606966 7.164669
##       65       66       67       68       69       70       71       72
## 8.159836 7.883401 8.574490 5.395483 5.395483 7.123204 5.948353 8.989143
##       73       74       75       76       77       78       79       80
## 8.159836 8.574490 8.068613 7.054095 8.574490 8.850925 8.823281 8.989143
##       81       82       83       84       85       86       87       88
## 8.850925 7.606966 7.963567 8.436272 8.491559 7.330530 7.883401 8.629777
##       89       90       91       92       93       94       95       96
## 8.989143 8.159836 7.717540 8.159836 6.501224 8.298054 7.883401 7.883401
##       97       98       99      100      101      102      103      104
## 8.574490 6.501224 8.850925 7.717540 6.777660 7.883401 7.883401 6.501224
##      105      106      107      108      109      110      111      112
## 7.883401 8.574490 8.751408 7.883401 7.883401 8.983614 7.883401 7.648431
##      113      114      115      116      117      118      119      120
## 7.330530 5.810136 8.795638 6.501224 8.436272 7.054095 7.192313 5.948353
##      121      122      123      124      125      126      127      128
## 7.717540 8.989143 7.606966 8.159836 6.224789 8.367163 6.501224 7.800470
##      129      130      131      132      133      134      135      136
## 6.915877 7.883401 8.878568 7.468748 7.054095 6.501224 5.119047 8.712707
##      137      138      139      140      141      142      143      144
## 7.330530 8.380985 8.795638 8.436272 8.795638 8.712707 7.054095 5.948353
##      145      146      147      148      149      150      151      152
## 8.989143 7.687132 7.330530 7.883401 8.712707 8.574490 8.408628 5.948353
##      153      154      155      156      157      158      159      160
## 7.026451 8.850925 8.436272 7.800470 7.054095 7.883401 8.436272 9.127360
##      161      162      163      164      165      166      167      168
## 7.330530 7.606966 8.298054 5.533700 9.072073 6.777660 7.883401 6.943521
##      169      170      171      172      173      174      175      176
## 8.187480 6.943521 8.989143 4.842612 7.330530 6.777660 6.501224 8.574490
##      177      178      179      180      181      182      183      184
## 4.842612 8.159836 9.058251 8.989143 8.068613 9.055487 7.745183 8.132193
##      185      186      187      188      189      190      191      192
## 7.745183 8.850925 8.712707 6.777660 8.795638 9.072073 5.948353 8.159836
##      193      194      195      196      197      198      199      200
## 7.524035 8.989143 8.090728 6.086571 7.330530 7.606966 8.602133 8.159836
```

```
#regular residuals
hist(rstandard(model1))
```




```
qqnorm(rstandard(model1))
#produce qq plot
qqline(rstandard(model1))
library(mosaic)

## Loading required package: dplyr

##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union

## Loading required package: lattice

## Loading required package: ggplot2

## Loading required package: mosaicData

## Loading required package: Matrix
```

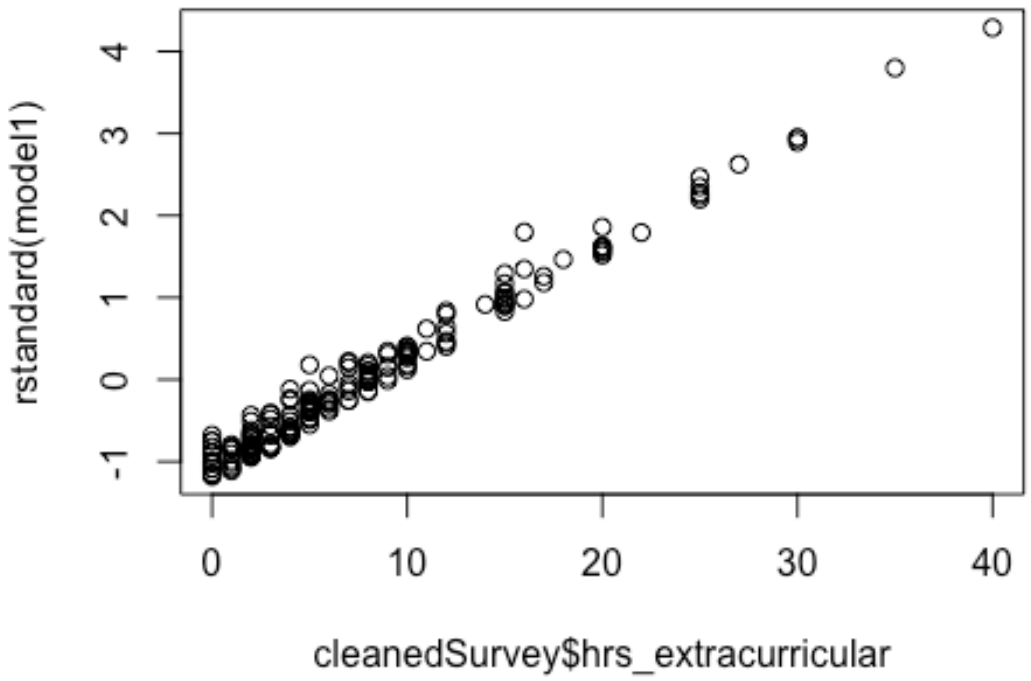
```
##
## The 'mosaic' package masks several functions from core packages in order
to add additional features.
## The original behavior of these functions should not be affected by this.

##
## Attaching package: 'mosaic'

## The following object is masked from 'package:Matrix':
##
##     mean

## The following objects are masked from 'package:dplyr':
##
##     count, do, tally

## The following objects are masked from 'package:stats':
##
##     binom.test, cor, cov, D, fivenum, IQR, median, prop.test,
##     quantile, sd, t.test, var

## The following objects are masked from 'package:base':
##
##     max, mean, min, prod, range, sample, sum
```



```
favstats(rstandard(model1))
```

```
##        min        Q1     median        Q3      max         mean       sd
##  -1.179023 -0.755902 -0.2746793 0.3409552 4.288378 0.0003007109 1.002529
##    n missing
##  200       0
```

```
#It does not appear that the residuals are approximately normally
distributed. They are right skewed.

#4(b)
#scatter plot of hrs extracurricular and standardized residuals
plot(cleanedSurvey$hrs_extracurricular,rstandard(model1))
```




```
#Is there any evidence of a non-linear trend in the residuals?
# No
#Is there any evidence of non-constant variance in the residuals?
# No
```