CS498 AMO Homework 6

Team :
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1. (**0 points**) **Page 1**: code for regression and resulting model.

```
Residuals:
    Min      1Q  Median      3Q     Max 
-15.595  -2.730  -0.518   1.777  26.199 

Coefficients:
              Estimate Std. Error t value Pr(>|t|)    
(Intercept)  3.646e+01  5.103e+00   7.144 3.28e-12 ***
crim        -1.080e-01  3.286e-02  -3.287 0.001087 ** 
zn           4.642e-02  1.373e-02   3.382 0.000778 ***
indus        2.056e-02  6.150e-02   0.334 0.738288    
chas         2.687e+00  8.616e-01   3.118 0.001925 ** 
nox         -1.777e+01  3.820e+00  -4.651 4.25e-06 ***
rm           3.810e+00  4.179e-01   9.116  < 2e-16 ***
age          6.922e-04  1.321e-02   0.052 0.958229    
dis         -1.476e+00  1.995e-01  -7.398 6.01e-13 ***
rad          3.060e-01  6.635e-02   4.613 5.07e-06 ***
tax         -1.233e-02  3.760e-03  -3.280 0.001112 ** 
ptratio     -9.527e-01  1.308e-01  -7.283 1.31e-12 ***
black        9.312e-03  2.686e-03   3.467 0.000573 ***
lstat       -5.248e-01  5.072e-02 -10.347  < 2e-16 ***
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Residual standard error: 4.745 on 492 degrees of freedom
Multiple R-squared:  0.7406,    Adjusted R-squared:  0.7338 
F-statistic: 108.1 on 13 and 492 DF,  p-value: < 2.2e-16
```
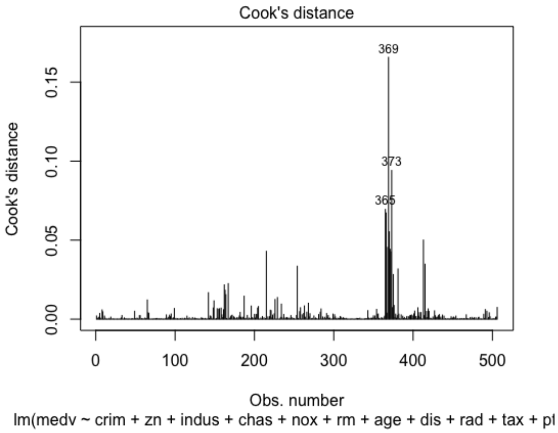
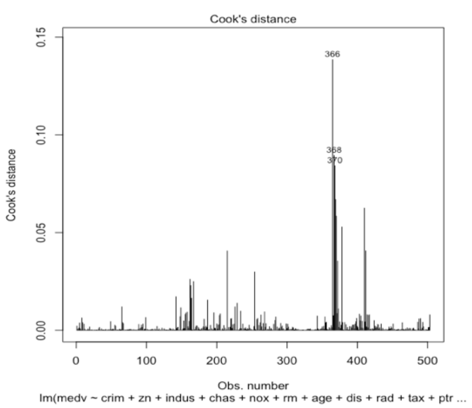
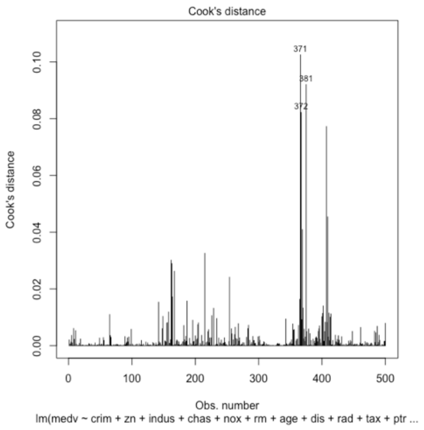

2. (**50 points**) **Page 2**: a screenshot of your diagnostic plot and a few sentences of your explanation.

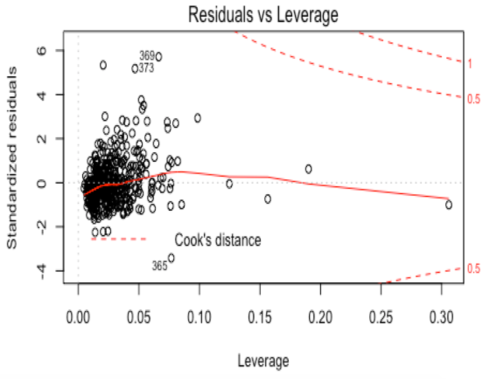
After regressing the house price on all the other 13 variables the R-squared is as follows:
[1] 0.7406427
Estimating cook distance, leverage(hat_matrix) and residuals(errors) we were able to indicate 10 outlier points on row indexes: 366, 368, 370,365, 369, 373,372,371,381,413
Cutoff Threshold for detecting outliers: 0.008163265

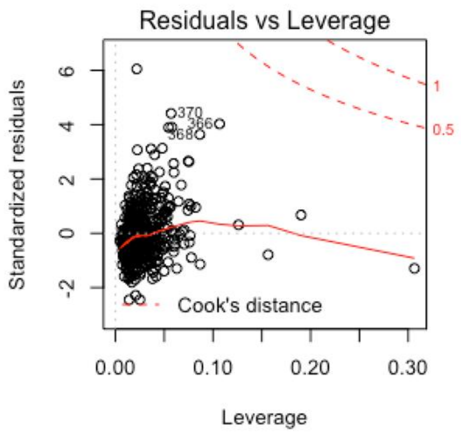
All of the listed outlier points have very high cook distance which makes them influential points. Any large difference from the 0 residuals with combination of high leverage makes them influential.
381, 413 have very high leverage
365- has very negative residual (more than 3 standard deviations below the mean)
366, 368, 370, 369, 373, 372, 371 have very high positive error values(residuals) more than 4 standard deviations above the mean.

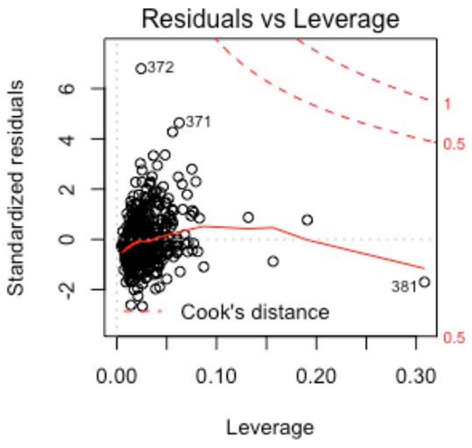






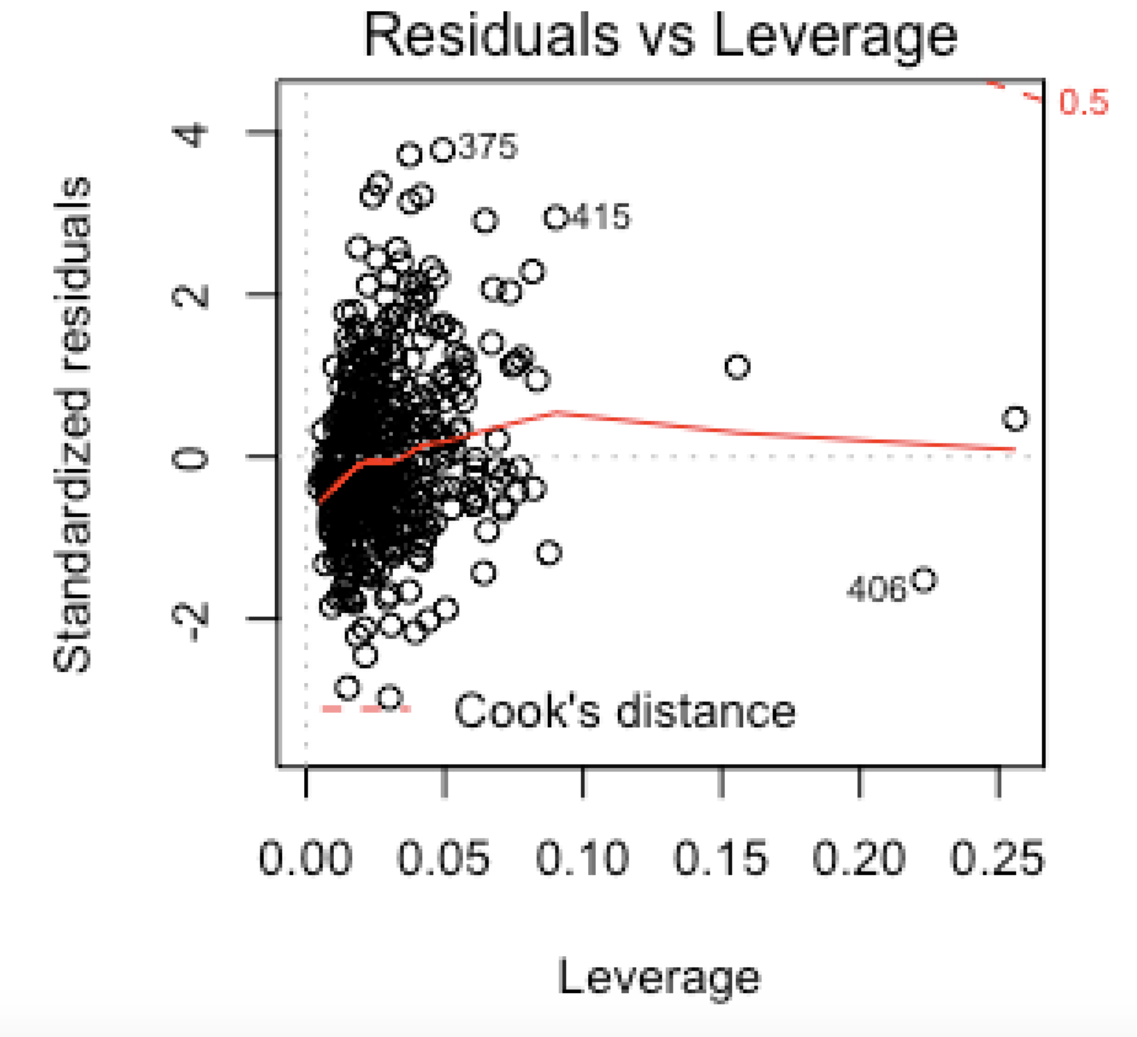






3. (**20 points**) **Page 3**: a screenshot of your new diagnostic plot.

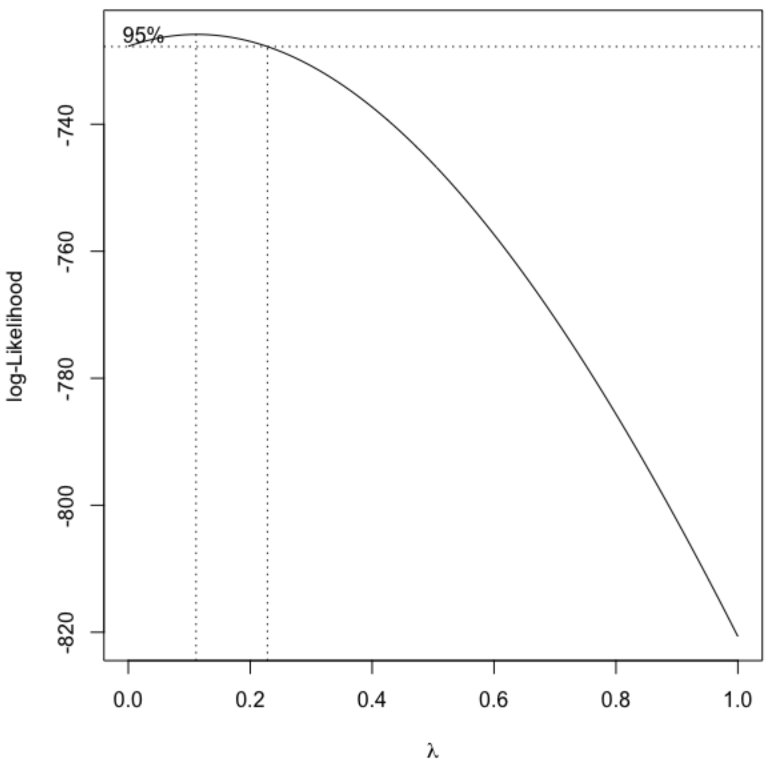
After removing the outliers R-squared metric became 0.8233966. We can see how the max leverage shrunk from 0.30 to 0.25 and all the points are within 4 standard deviations far from the mean. This is still far comparing with the general advice to try to keep them between 3 standard deviations but also, we have ~500 observations and we already took out 10 which is already 2% of the data and we can see there are wide number of points being more than 3 standard deviations from the positive side of the mean. Which shows that the data is a little skewed.



4. (**10 points**) **Page 4**: a screenshot of your code for subproblem 2.

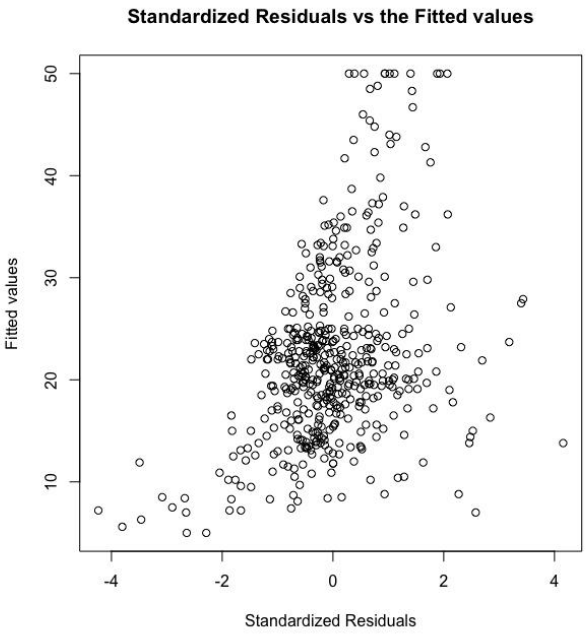
5. (**10 points**) **Page 5**: a screenshot of Box-Cox transformation plot and the best value you chose.

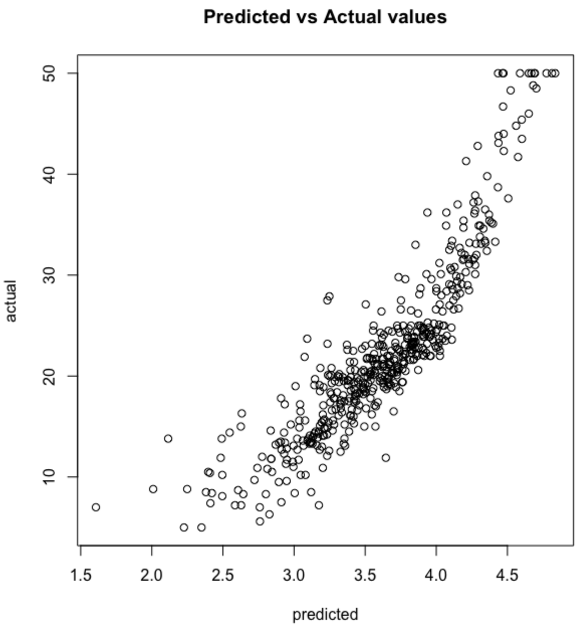
The best value of lambda is 0.1111111



6. (**10 points**) **Page 6**: result of the standardized residuals of the regression after Box-Cox transformation and a plot of fitted house price against true house price.

   After fitting linear regression with box-cox transformation the new R-squared value became: 0.8348808





7. (**0 points**) **Page 7**: code for subproblems 3 and 4.

Libraries used & Reference:

David Forsyth's book - Applied Machine Learning
Trevor Walker's lecture and sample code – CS-498 Lecture videos
Accelerometer dataset - https://archive.ics.uci.edu/ml/datasets/Dataset+for+ADL+Recognition+with+Wrist-worn+Accelerometer