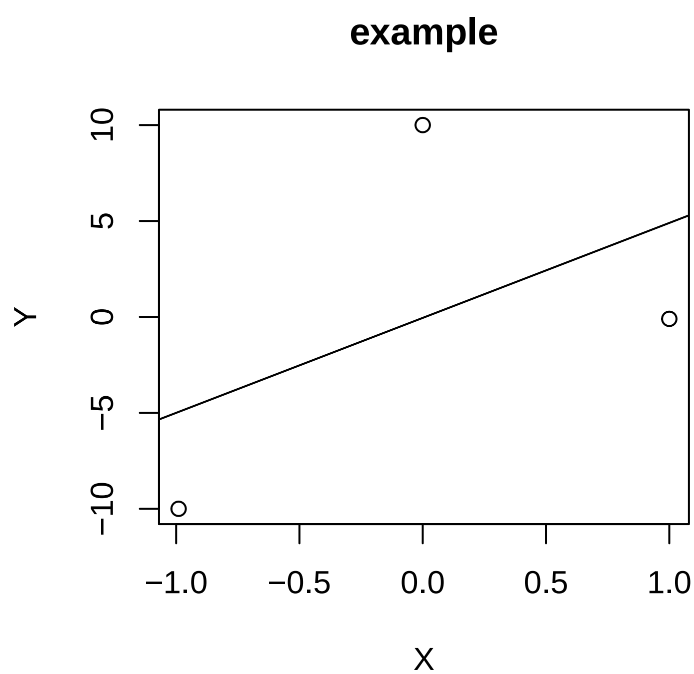
ECN221 Exam 3 Fall 2016, ASU-COX
EXPLANATIONS TO SELECTED PROBLEMS

Most of the questions follow immediately from definitions in the textbook and lectures or from problems worked in class with examples in the homework etc. Here are explanations for a few of that involved more “critical thinking”.

- Suppose you see that for all values of your dependent variable that are above the mean, the value of the independent variable (in a regression) are below the mean. (You can draw a picture if you aren’t sure what this looks like).

  Explanation: To prove a result for this you might need to recall the formula for the slope or at least for the covariance which is in the formula sheet. But that is not required. If you were “eyeballing” it you might have tried a plot such as the one below and coneptually you needed to recognize that in the question you don’t have any information about what happens when the dependent variable is below the mean. Consider the following data set with x, y pairs: (-.99,-10), (1, -.1), (0,10).



```
##
## Call:
## lm(formula = y ~ x, data = dd)
##
## Residuals:
##     1     2     3
## -5.05 -5.00 10.05
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.04983    7.10639  -0.007    0.996
## x            4.94950    8.74715   0.566    0.672
##
## Residual standard error: 12.31 on 1 degrees of freedom
## Multiple R-squared:  0.2425,Adjusted R-squared:  -0.5149
## F-statistic: 0.3202 on 1 and 1 DF,  p-value: 0.6722
```

In the example the slope is positive. We have to consider that we do not know in this question what happens when the dependent variable is below the mean. If the for all values of your dependent variable that are above the mean the value of the independent variable (in a regression) are below the mean *and* for all values of the dependent variable that are below the mean the value of the independent variable is above the mean then the slope will be negative.

- Suppose you find the following estimated equation

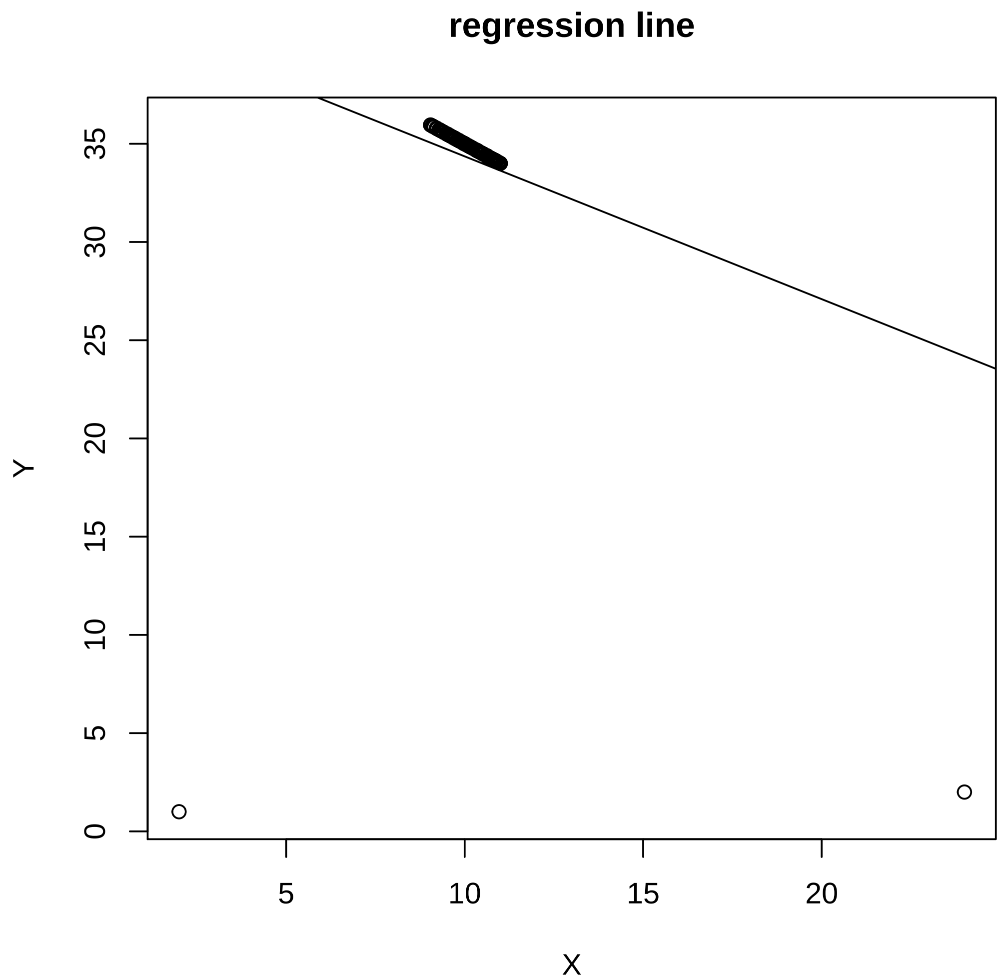
$$\hat{y} = 12 + 2.3X.$$

and you find $\hat{y}_1 = 20$ for a specific value X_1. Suppose that you are interested now in finding the predicted value, $\hat{y}_2$ for X_2 where X_2 is twice the value of X_1. What is $\hat{y}_2$?

1. 40.8.
2. 28.
3. 20.
4. 36.
5. 26.4.

Explanation: in this example you know that $X_1 = (20 - 12)/2.3 = 3.4782609$ by working backwards. Then work forwards again with $\hat{y}_2 = 12 + (2.3)(2)(3.478) = 28$.

- The following graph shows 102 observations and the resulting regression line. Notice that all but 2 observations are close together and the points representing the 100 close together observations visually merge together to form a thick black line above the regression line. Choose the best option below.



1. It appears that the residuals have non constant variance.
2. It appears that the residuals do not have an average of 0.
3. It appears that the regression line is biased.
4. It appears that the standard deviation of the residual is around 80 to 100.

Explanation: We can eliminate wrong answers. "It appears that the residuals do not have an average of 0" is wrong since the average of the residuals is 0 and the graph does not have any speical optical illusion inthat regard. "It appears that the regression line is biased" is wrong because without further information it is unclear that we would know whether the estimator is biased and there is nothing in the graph to suggest this. As for the standard deviation I can eyeball it and gather that the variance is around $(40^2 + 25^2 + 100)/100$ which is about 23.25 so that the standard deviation would be around 4.8218254. So that even if you had approximated it with $(50^2 + 30^2 + 500)/100$ you would have had around 6.244998 so still not even close. Then look at the observations around where X is 10 and notice that the smaller values of X tend to be further from the line (larger varaince for the residual) and the larger values of X tend to be closer to the regression line (smaller variance of the residual) which suggests non constant variance.