Stats 206 - Homework 1

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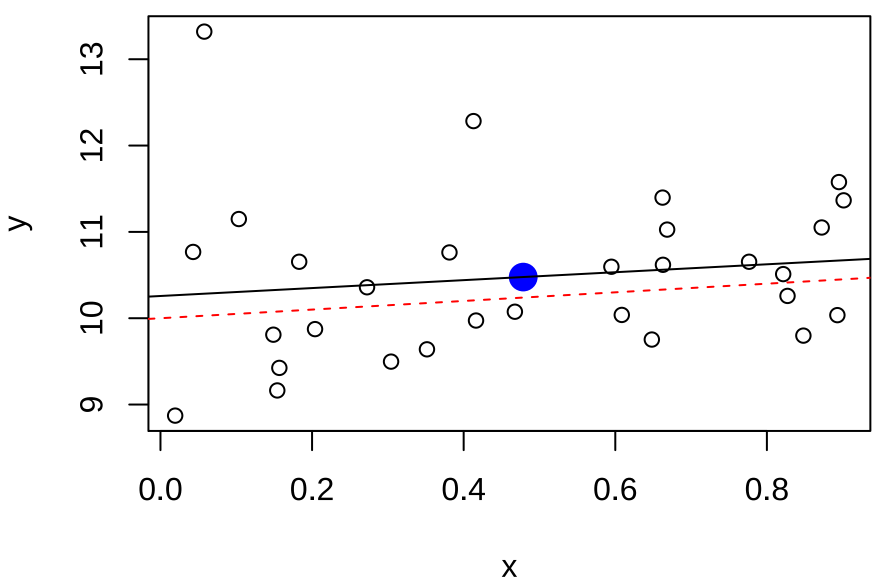
2. True / False

a **True** The least squares line always passes the center of the data. This is implied by the formula

$$\hat{\beta}_0 = \bar{Y} - \hat{\beta}_1 \bar{X}.$$

The large point in the below plot is the center of the data. The solid line interpolating it is the fitted regression line.



b **False** The least squares line fits the data best by definition. All other lines, including the true line, are worse than the least square lines in this respect. In the figure above the fitted regression line is the solid line, while the true regression line is the dashed line. They are not the same.

c **True** $\bar{X} = 0$ and $\bar{Y} = 0 \implies \hat{\beta}_0 = 0$. This is implied by the equation in part a).

d **True** The standard errors for β_0 and β_1 both have a term with $\sum(X_i - \bar{X})$ in the denominator. Hence increasing the range of the X_i's decreases the standard error estimates.

e **True** It's harder to predict than to infer the mean.

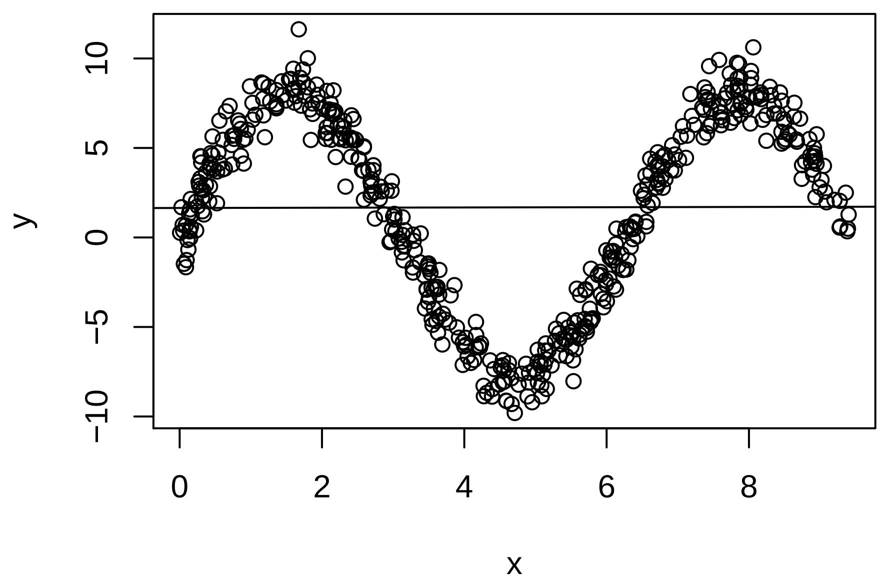
f **True** A 95% confidence interval represents our confidence that the true value lies in that interval.

g **True** One sided and two sided t tests are different, for example.

h **True** For most data sets there are generally fewer data points far from the mean, which makes estimation more difficult.

i **True** Assuming that the regression coefficients are well defined, the least squares line will interpolate collinear points. This implies that $y_i = \hat{y}_i$ for all $y_i \implies SSR = SSTO \implies R^2 = 1$.

j **False** A small R^2 does not mean that the predictor and response are not related; the relationship may be nonlinear. In the graph below the points were generated from a sine function plus random normal noise. The R^2 for the fitted line is nearly 0.



k **False** It can be difficult to detect nonlinearity using a scatterplot depending on the scale of the variables. Plotting the residuals of a linear model is more reliable. An example was shown in the third lecture demonstrating this.