1. Least-squares regression line
2. Derive expressions for and that give the minimal value of the two-argument function defined by . (Hint: is called the intercept and the slope of the least-squares regression line, which is .)

Take the partial derivative with respect to and find its min value

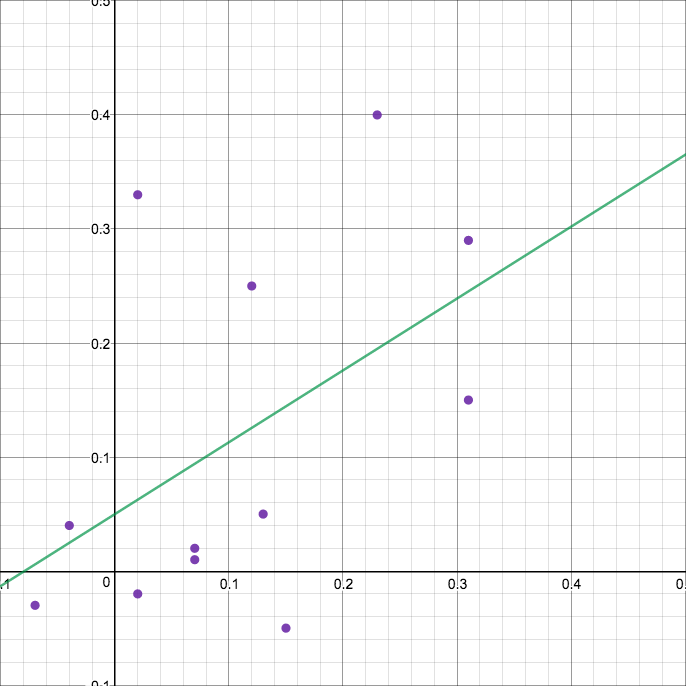
Take the partial derivative with respect to and find its min value

Finally, substitute in to find

1. Construct empirical estimators and for and , respectively, and then compute the estimators and draw the corresponding least-squares regression line using the following data:

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|  | 0.15 | 0.13 | 0.07 | 0.12 | -0.04 | 0.31 | 0.23 | 0.31 | 0.02 | -0.07 | 0.07 | 0.02 |
|  | -0.05 | 0.05 | 0.01 | 0.25 | 0.04 | 0.15 | 0.40 | 0.29 | 0.33 | -0.03 | 0.02 | -0.02 |

Therefore,



1. Prove the equation

where is the covariance between and , and is the correlation between and . (Note: The left-hand side of equation is the famous “beta” that every financial portfolio manager knows and uses on the daily basis, with being the market return and the fund return.)

Therefore,

1. Prove that the mean squared error between the least squares predictor of the response variable is equal to where is the variance of and is the correlation between and .

Doesn’t work unless