# Assignment 4

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For simplicity, we will fit a normal distribution,$N(\mu, \sigma)$, to this data. The maximum likelihood estimation problem we try to solve is to choose the vector of parameters $(\mu, \sigma)$ that maximizes the likelihood of fitting our data (that is, our income variable), given the assumption that the data came from a normal distribution $N(\mu, \sigma)$. Let the probability density function of the normal distribution be represented by $f(x|\mu, \sigma)$. Then the following is the equation (1) of the maximum likelihood estimation.

In order to use an algorithm to solve this problem, we need to rewrite it as a minimization problem whose estimation function (equation (2)) is shown below. Since we assume the normal distribution here, we have the exactly identical estimators of an OLS regression.

$$max_{\mu,\sigma} ln(I) = \sum_{n=1}^{N} ln(f(hlabinc_n|\mu, \sigma)) \tag{1}$$

$$min_{\mu,\sigma} - ln(I) = -\sum_{n=1}^{N} ln(f(hlabinc_n|\mu, \sigma)) \tag{2}$$

In terms of the coefficients of $educ$, we see an increase from around 0.07 to 0.11, which shows the importance of education in determining the average wage over the year.These positive and significant coefficients measure that more education years are correlated with a higher wage.