

Problem Set #2

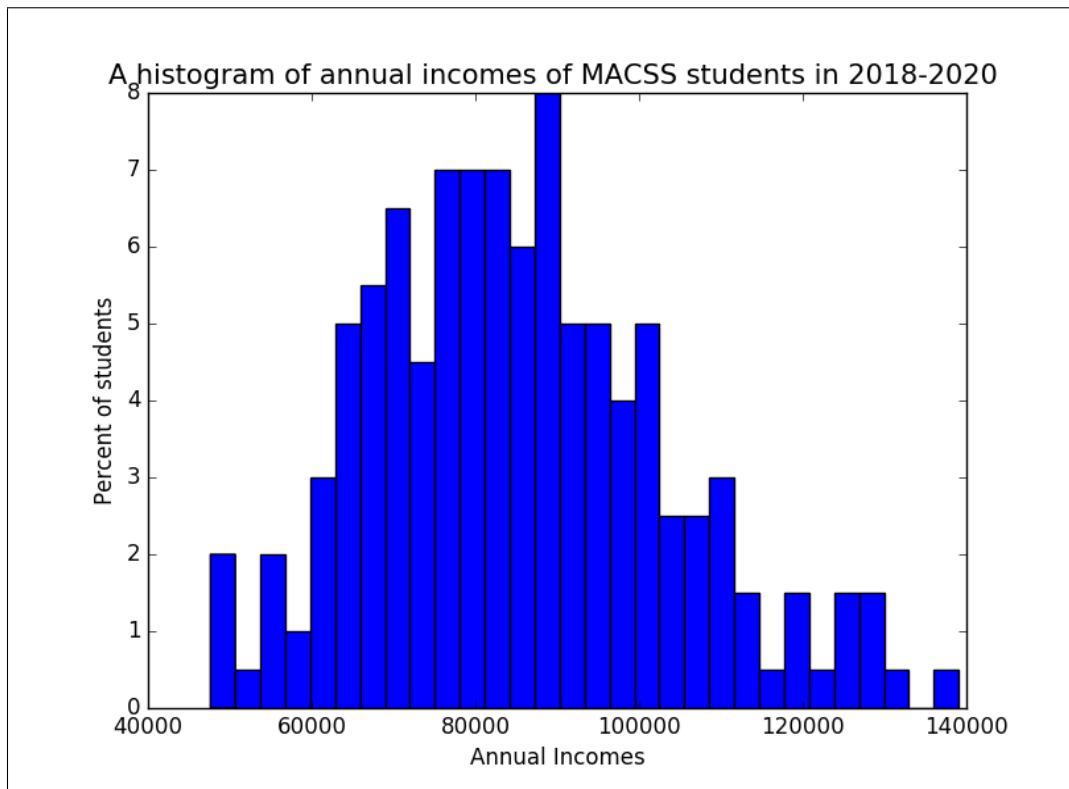
MACS 30100, Dr. Evans

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Problem 1: Some income data, lognormal distribution, and hypothesis testing

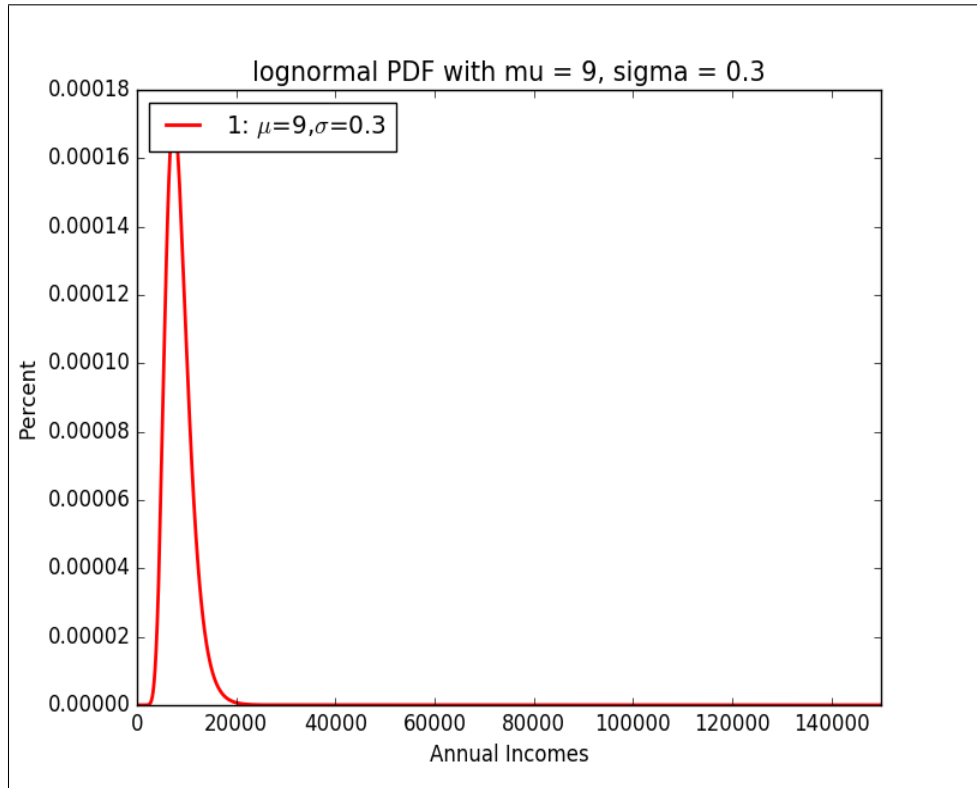
(a)

Figure 1: Histogram



(b)

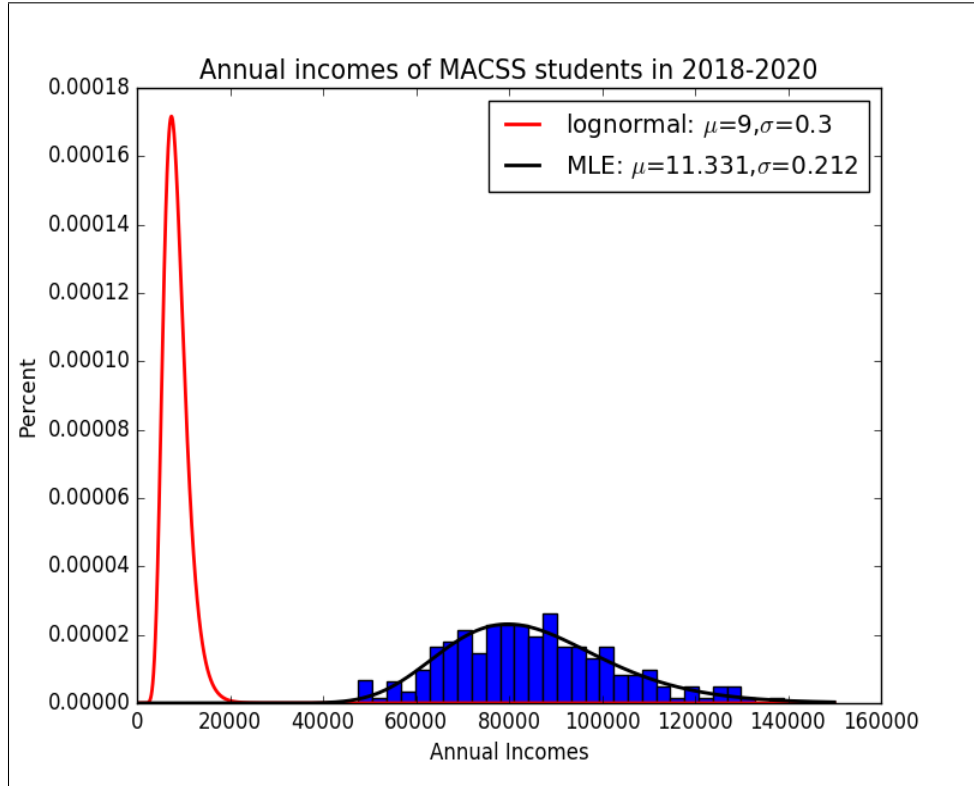
Figure 2: PDF



The log likelihood value for $\mu = 9$, $\sigma = 0.3$ is -8298.63696.

(c)

Figure 3: Graphs



The MLE for mu is 11.33144 and the MLE for sigma is 0.21167.

The value of the likelihood function is: -2239.53474.

The Variance-covariance matrix(VCV(MLE)) is

$$\begin{bmatrix} 3.15303513e-04 & 4.26408957e-06 \\ 4.26408957e-06 & 1.12288299e-04 \end{bmatrix}$$

(d) Chi squared of H0 with 2 degrees of freedom p-value is 0.0. P-value is in the rejection area so that we can conclude that the data in income.txt is not came from the distribution in part(b).

(e) The probability that the student will earn more than \$ 100,000 is 19.56 The probability that the student will earn less than \$ 75,000 is 30.79

Problem 2: Linear regression and MLE

(a) The MLE for sigma is 0.00302. The MLE for sigma squared(variance) is 0.06333. The MLE for b0 is 0.25165 and the MLE for b1 is 0.01293. The MLE for b2 is 0.40050 and the MLE for b3 is -0.00999.

The value of the likelihood function is: 876.86505.

The Variance-covariance matrix(VCV(MLE)) is

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

(b) Chi squared of H0 with 2 degrees of freedom p-value is 0.0. P-value is in the rejection area so that we can conclude that the age,number of children, and average winter temperature have effect on the number of sick days.