Problem Set #[2]

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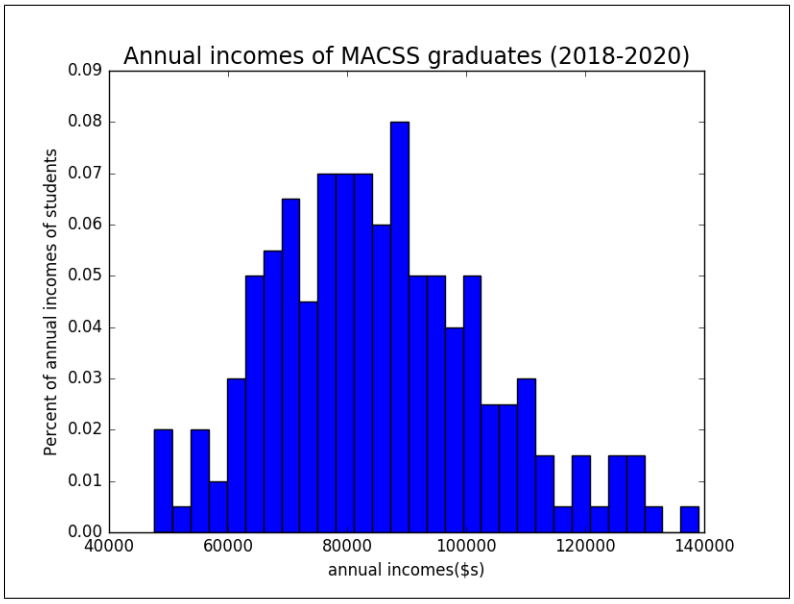
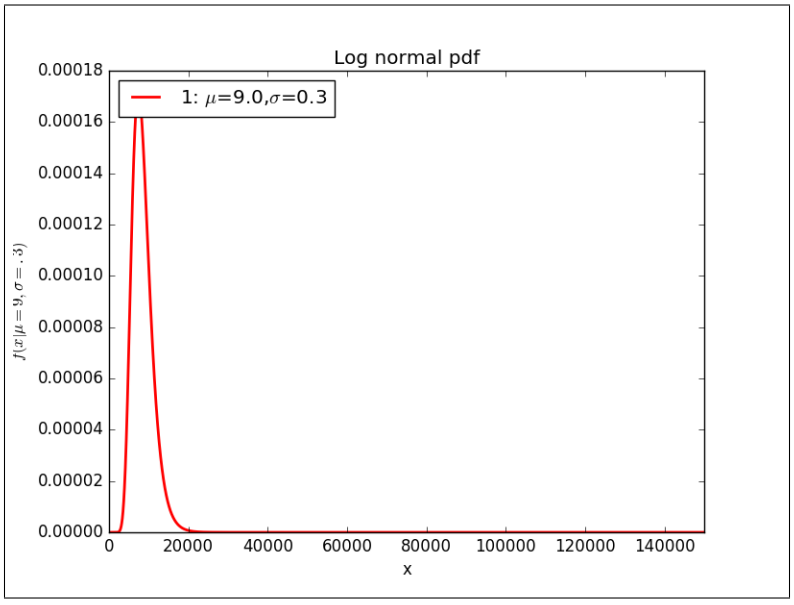
Problem 1

Part (a).Plot a histogram

The histogram of annual incomes of students who graduated in 2018, 2019, and 2020 from the University of Chicago MACSS program is as below:

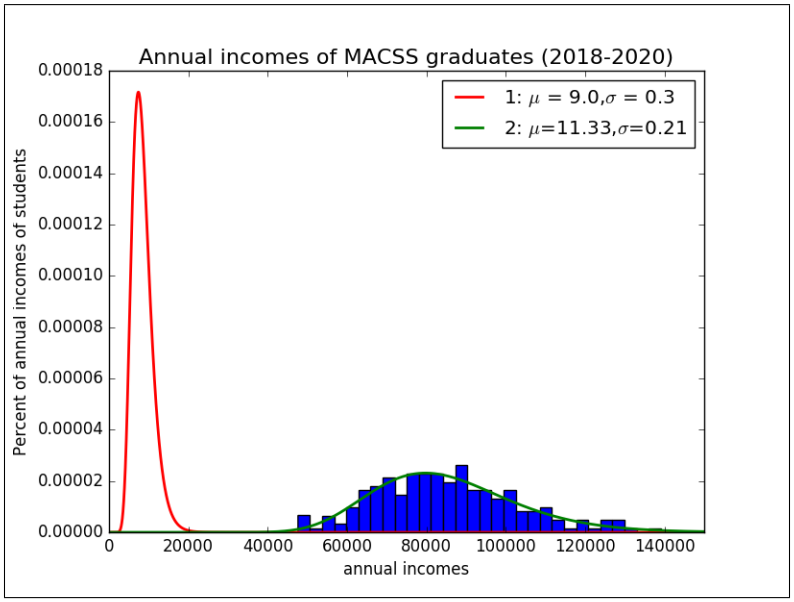


Part (b).Log PDF and log likelihood



Value of the log likelihood is: -8298.63695601

Part (c).MLE



The value of Log-likelihood function is: -2239.534744

The MLE estimate parameters are as below:

$$MLEestimate\mu = 11.3314403262$$
$$MLEestimate\sigma = 0.211674580397$$

$$\text{VCV}_{(}MLE) = \begin{bmatrix} 2.22214155\text{e-}04 & -5.61369430\text{e-}07 \\ -5.61369430\text{e-}07 & 1.12310760\text{e-}04 \end{bmatrix}$$

Part (d).likelihood ratio test

From chi squared of H0 with 2 degrees of freedom, we can know the p-value is 0.0.

Part (e).

Probability that I will earn more than $100,000 is 0.196 Probability that I will earn less than $75,000 is 0.308

Problem 2

Part (a).MLE

The value of Log-likelihood function is: 876.865046414609
The MLE estimate parameters are as below:

$$MLEestimate\beta_0 = 0.251646265218$$

$$MLEestimate\beta_1 = 0.0129333458728$$

$$MLEestimate\beta_2 = 0.40050209353$$

$$MLEestimate\beta_3 = -0.0099916690296$$

$$MLEestimate\sigma = 0.00301768768568$$

$$\text{VCV}_(MLE) =$$

$$\begin{bmatrix} 8.04161587\text{e-}07 & 1.22767134\text{e-}09 & -9.08556283\text{e-}08 & -1.56112623\text{e-}08 & -1.25989887\text{e-}08 \\ 1.22767134\text{e-}09 & 2.00398389\text{e-}09 & -1.63752155\text{e-}08 & -1.23747827\text{e-}09 & -5.92335814\text{e-}10 \\ -9.08556283\text{e-}08 & -1.63752155\text{e-}08 & 1.72498499\text{e-}07 & 1.04474878\text{e-}08 & 6.52192033\text{e-}09 \\ -1.56112623\text{e-}08 & -1.23747827\text{e-}09 & 1.04474878\text{e-}08 & 1.09878616\text{e-}09 & 4.84193753\text{e-}10 \\ -1.25989887\text{e-}08 & -5.92335814\text{e-}10 & 6.52192033\text{e-}09 & 4.84193753\text{e-}10 & 2.07961106\text{e-}08 \end{bmatrix}$$

Part (b).likelihood ratio test

From chi squared of H0 with 5 degrees of freedom, we can know the p-value is 0.0.This result imply that the likelihood that age, number of children, and average winter temperature have no effect on the number of sick days is very low