

## Question 1

Given,  $P(x | \theta) = (\theta e^{-\theta x}, \text{ if } x \geq 0)$   
 $= (0, \text{ otherwise})$

MLE performs a series of operation to find the maximum likelihood.

Necessary conditions for an optimum:

$$\nabla_{\theta} l = \sum_{k=1}^{k=n} \nabla_{\theta} \ln p(x_k | \theta)$$
$$\nabla_{\theta} l = 0$$

$$\sum_{k=1}^n \Delta \ln(\theta e^{-\theta x})$$

$$\Rightarrow \theta^n \sum_{k=1}^n e^{-\theta x} - \theta x$$

$$\Rightarrow L(\theta) = n \ln \theta + (-\theta x)$$

$$\Delta \ln(\theta) = 0$$

$$\Rightarrow n/\theta - \sum_{k=1}^n x_k = 0$$

$$\Rightarrow n/\theta = \sum_{k=1}^n x_k$$

$$\Rightarrow \theta/n = 1/\sum_{k=1}^n x_k$$

$$\Rightarrow \theta = \frac{1}{(1/n) \sum_{k=1}^n x_k}$$

## MLE Classifier

Mean Accuracy for 10 iteration = 74.34895833333334

Mean Std. Deviation of accuracy = 1.82601423333300883

## KNN Classifier

k =1:

Mean Accuracy for 10 iteration = 65.88541666666666

Mean Std. Deviation of accuracy = 1.669738199797861

K=5:

Mean Accuracy for 10 iteration = 70.10416666666667

Mean Std. Deviation of accuracy = 1.769641483447501

K=11:

Mean Accuracy for 10 iteration = 71.77083333333333

Mean Std. Deviation of accuracy = 1.629541670869071