Note: Attempt all questions. Submit hand written or Typed solution in a single file.

1. A life time X of a machine is modeled by an exponential distribution with unknown parameter θ. The likelihood is

$$p(X \mid \theta) = \theta e^{-\theta X} \qquad X \geq 0, \theta > 0$$

   (a) Get mle of θ.

   (b) Suppose we observe $X_1 = 5, X_2 = 6, X_3 = 4$ (the lifetime in years) of 3 different iid machines. What is the MLE, given this data?

2.

X	94	96	94	95	104	106	108	113	115	121	131
$t \mid y$	0.47	0.75	0.83	0.98	1.18	1.29	1.40	1.60	1.75	1.90	2.23

   (a) Fit a linear regression model. Fit polynomial for order 1, 3 and 5. (may use Python code to do this).

   (b) And then apply regression with L_2 regularization.

   (c) Submit parameters value and graph for each case as a result.

3. What are the differences between GINI index and Entropy as a measure for split in Decision tree.