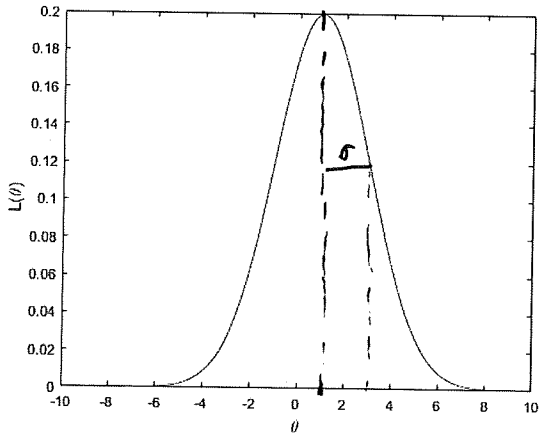


Quiz 5

100 points (10 points per problem)
(Version A)

Problem 1

The following distribution was found when performing a parameter estimation. What is the maximum likelihood estimate and the standard error? Write the code that generated the axis labels.



$$\text{MLE is } \theta = 1$$

$$\text{SE is } \sigma \approx 2$$

$$\theta = 1 \pm 2$$

Problem 2

Under what conditions is least-squares fitting the same as a maximum likelihood estimate of the parameters?

Noise is Gaussian distributed

Problem 3

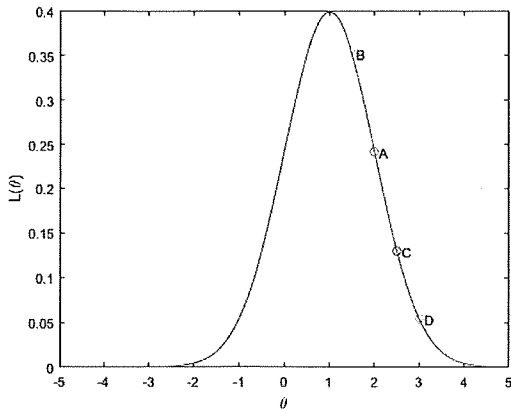
Write code that would create and then use an anonymous function.

$$f = @(x) x^2$$

$$y = f(3)$$

Problem 4

The probability distribution below is being explored using Markov-Chain Monto-Carlo. If the chain starts at 'A', what is the probability that a jump to 'B', 'C', or 'D' is accepted? How did I put the letters on the plot?



probability of acceptance is

$$p \quad a = \frac{L(\theta_{\text{next}})}{L(\theta_{\text{current}})}$$

$$A \rightarrow B \quad a > 1 \quad \text{so} \quad 100\%$$

$$A \rightarrow C \quad a \sim \frac{1}{2} \quad \text{so} \quad 50\%$$

$$A \rightarrow D \quad a \sim \frac{1}{5} \quad \text{so} \quad 20\%$$

Problem 5

What program did/will you use to generate your Latex document for homework 10? List two advantages of using Latex over Microsoft Word or other word processors.

I like WinEdt + MikTeX.

free
creates production ready documents

Easier/Better when document has many equations

⋮

Problem 6

List four significant differences between Matlab and Python.

matlab is 1-based, Python 0-based

python is free

python needs modules to be useful for science apps.

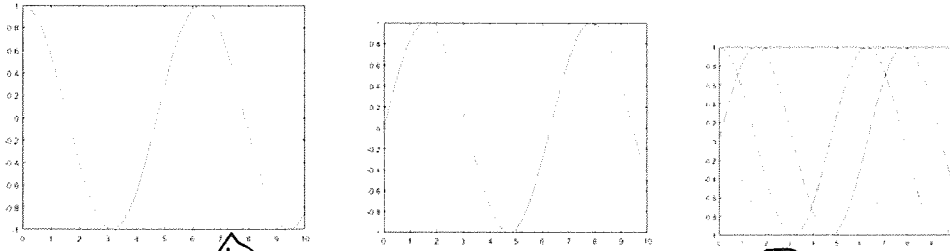
need to import modules to use them

Syntax

⋮

Problem 7

Match the code block to the figure.



```
figure
plot(X,cos(X))
plot(X,sin(X))
```

```
figure
plot(X,cos(X))
hold on
plot(X,sin(X))
```

```
figure
plot(X,sin(X))
hold off
plot(X,cos(X))
```

Problem 8

A set of numbers $X = \{x_1, x_2, \dots, x_N\}$ are drawn from the exponential distribution: $P(x|\lambda) = \lambda e^{-\lambda x}$. Show a derivation for an analytical expression for the maximum likelihood estimate of λ given the data set X .

$$L(\lambda) \equiv P(X|\lambda) = \prod_n \lambda e^{-\lambda x_n}$$

$$\ln L(\lambda) = \sum_n [\log \lambda - \lambda x_n]$$

max where

$$\frac{\partial \ln L(\lambda)}{\partial \lambda} = 0 = \frac{N}{\lambda} - \sum_n x_n$$

$$\lambda = \frac{1}{\frac{1}{N} \sum_n x_n} = \frac{1}{\langle X \rangle}$$

Problem 9

Write code that would create and then use a class.

```
classdef myAdd < handle
    properties
        A
        B
    end
    methods
        function C = addEm(obj)
            C = obj.A + obj.B
        end
    end
end
M = myAdd()
M.A = 1
M.B = 2
X = M.addEm()
```

Problem 10

What was your favorite aspect of 290?

The students!