Mathematical Modeling and Simulation **University of Minnesota**
AEM 3103 **March 7, 2023**

Practice Problems for Exam #1

1. Matrix and array operations: If $\mathbf{A}$ is a matrix given by:

$$\mathbf{A} = \begin{bmatrix} 1 & 2 & 3 & 4 \\ \pi & \sqrt{2} & \sqrt{3} & 9.81 \end{bmatrix}$$

is input into MATLAB. Write the output that will result from the following command line inputs:

(a) `>> A(1,:)`
(b) `>> A(:,3)`
(c) `>> A(:,1:3)`
(d) `>> A(1:3,:)`

2. What is the value of x in the the following MATLAB commands?

(a)
```
>> theta = 30;      % angle in degrees
>> x = cos(theta);
```

(b)
```
>> x = exp(log(8/2^3));
```

(c)
```
>> A = [1 3;2 5];
>> x = det(A);
```

(d)
```
>> f = @(y) sin(y)/y + sqrt(y);
>> q = pi/2;
>> x = f(q);
```

3. The function `quadratic` uses the quadratic formula to determine the roots r_1 and r_2 of of a quadratic function $f(x) = ax^2 + bx + c = 0$. Complete the missing line(s) in the function.

```
function [r1, r2] = quadratic(a,b,c)

d = sqrt(b^2 - 4*a*c);
r1 = -b + sqrt(4*a*c);
```

4. Consider the following two arrays:

```
>> x = linspace(1,10,1000);
>> y = linspace(pi,pi^2,1000);
```

We want to compute

$$S = \sqrt{\sum_{i=1}^{1000} x(i)y(i)}$$

Without using a `for` loop (or any other loops for that matter), write a *single line* MATLAB statement that will calculate S.

5. Determine the output of the following MATLAB statements:

   (a) `>>Q1=[0:.1:.3]'`

   (b) `>>a=@(x)cos(x); Q2=a(0)`

   (c) `>>Q3=3*12/3^2/2+2`

   (d) `>>Q4=[5 2 7].^[2 3 1]`

   (e) `>>Q5=[5 2]*[3 4]'`

   (f) `>>Q6=[5 2]*[3 4]`

   (g) `>>Q7=[5 2]'*[3 4]`

   (h) `>>Q8=3+2<4<3`

   (i)
```
>> if [1 0]
       disp('AEM 3101')
   end
```

6. Consider the following MATLAB script that processes the data file `VariEzeCM.txt`.

```
clear all;
close all;
clc;

data = input('VariEze_CM.txt');
a = data(:,1);
CM = data(:,2);

figure(1)
h1 = plot(a,CM,'r-');
h2 = plot(a,CM,'ko');
grid on;
set(h1,'LineWidth',2);
```

```
set(h2,'MarkerSize',10,'MarkerFaceColor','k');
xlabel('\alpha');ylabel('C_M');
```

Which of the following plots was created by this script?