



Assignment 1

Course Code: CSE – 3116

Course Title: Numerical Methods Sessional

Submitted To:

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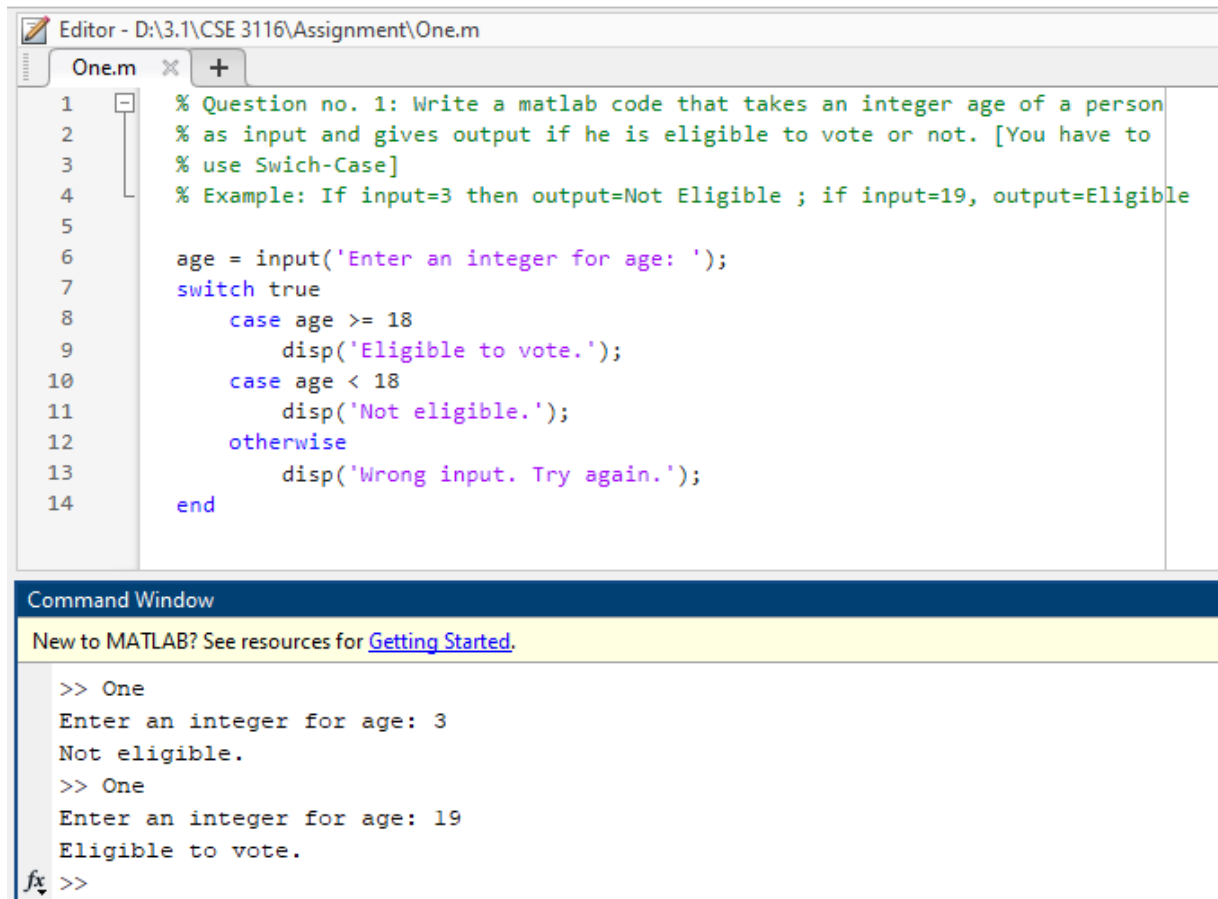
Leading University

Date of Submission: 20 October, 2024

Problem 1: Write a MATLAB code that takes an integer age of a person as input and gives output if he is eligible to vote or not. [You have to use Switch-Case]

Example: If input=3 then output=Not Eligible; if input=19, output=Eligible

The code and output:



The image shows a MATLAB Editor window with a file named 'One.m' and a Command Window below it. The code in the editor uses a switch-case structure to check if an age is 18 or older. The Command Window shows the execution of the code for two different inputs: 3 and 19.

```
Editor - D:\3.1\CSE 3116\Assignment\One.m
One.m
1 % Question no. 1: Write a matlab code that takes an integer age of a person
2 % as input and gives output if he is eligible to vote or not. [You have to
3 % use Swich-Case]
4 % Example: If input=3 then output=Not Eligible ; if input=19, output=Eligible
5
6 age = input('Enter an integer for age: ');
7 switch true
8     case age >= 18
9         disp('Eligible to vote.');
```

Command Window

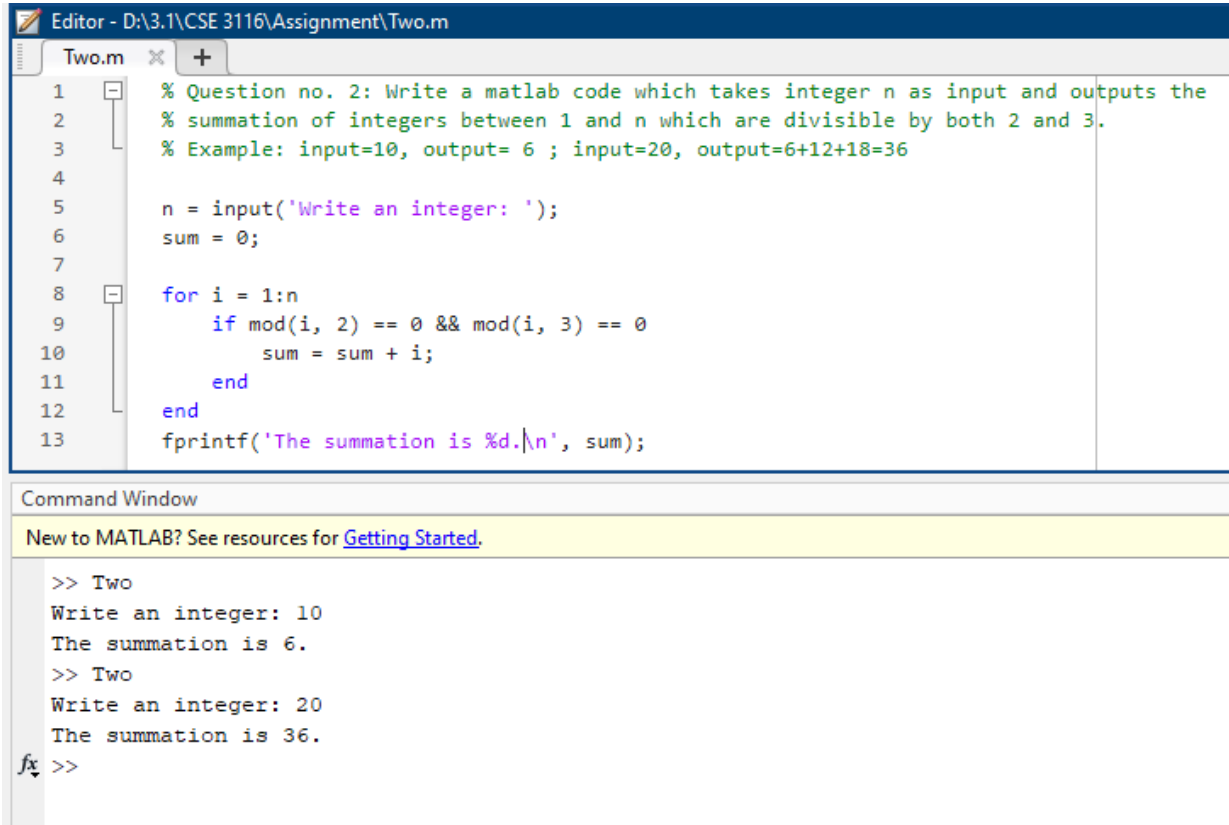
New to MATLAB? See resources for [Getting Started](#).

```
>> One
Enter an integer for age: 3
Not eligible.
>> One
Enter an integer for age: 19
Eligible to vote.
fx >>
```

Problem 2: Write a MATLAB code which takes integer n as input and outputs the summation of integers between 1 and n which are divisible by both 2 and 3.

Example: input=10, output= 6; input=20, output=6+12+18=36

The code and output:



The image shows a MATLAB environment with an Editor window and a Command Window. The Editor window displays a MATLAB script named 'Two.m' with the following code:

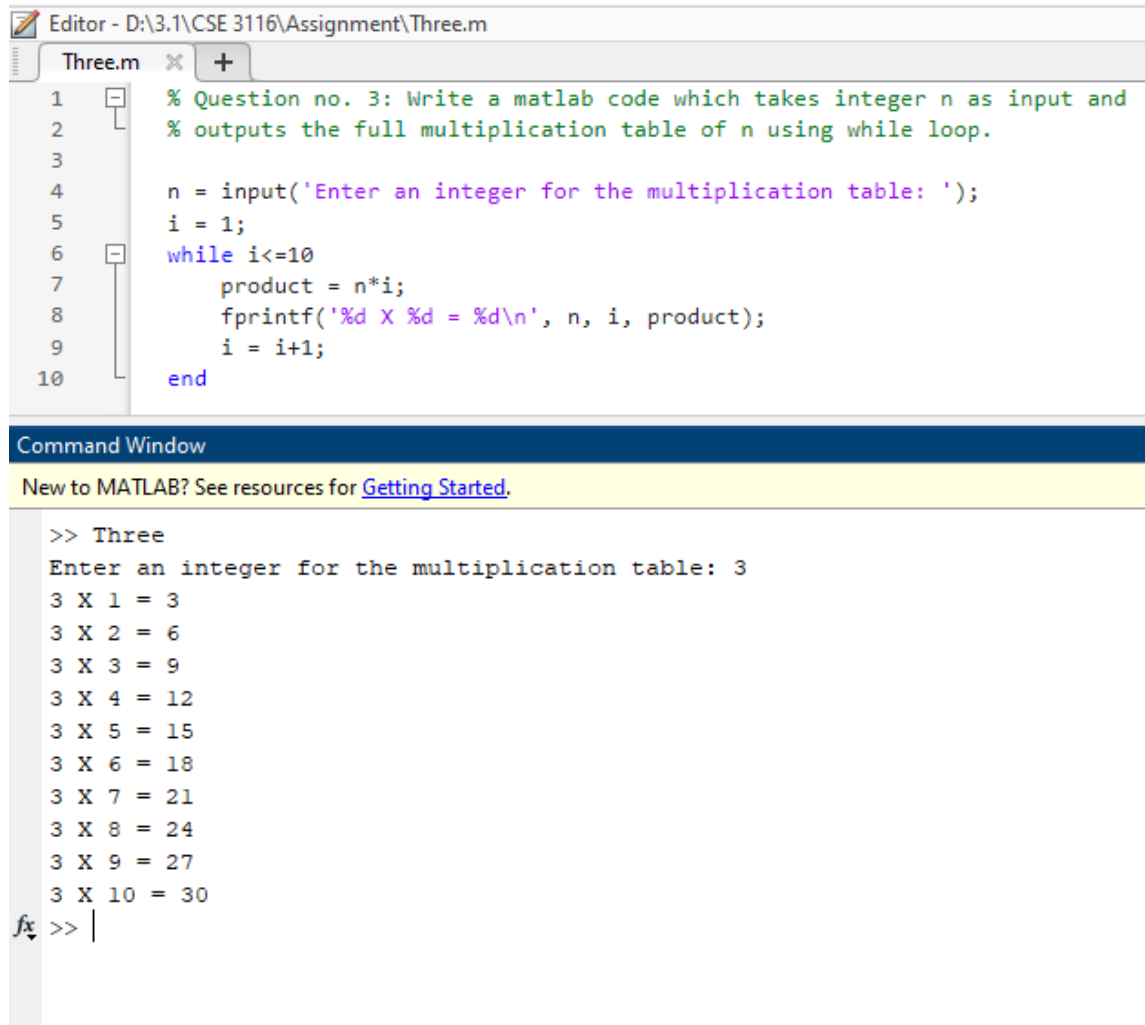
```
1 % Question no. 2: Write a matlab code which takes integer n as input and outputs the
2 % summation of integers between 1 and n which are divisible by both 2 and 3.
3 % Example: input=10, output= 6 ; input=20, output=6+12+18=36
4
5 n = input('Write an integer: ');
6 sum = 0;
7
8 for i = 1:n
9     if mod(i, 2) == 0 && mod(i, 3) == 0
10         sum = sum + i;
11     end
12 end
13 fprintf('The summation is %d.\n', sum);
```

The Command Window shows the execution of the script 'Two' twice. The first execution takes input 10 and outputs 6. The second execution takes input 20 and outputs 36.

```
>> Two
Write an integer: 10
The summation is 6.
>> Two
Write an integer: 20
The summation is 36.
fx >>
```

Problem 3: Write a MATLAB code which takes integer n as input and outputs the full multiplication table of n using while loop.

The code and output:



The image shows a MATLAB environment with two windows. The top window is the 'Editor' showing a script named 'Three.m'. The script contains a comment and a while loop that generates a multiplication table for a user-input integer n. The bottom window is the 'Command Window' showing the execution of the script, where the user enters '3' and the program outputs the multiplication table for 3 from 1 to 10.

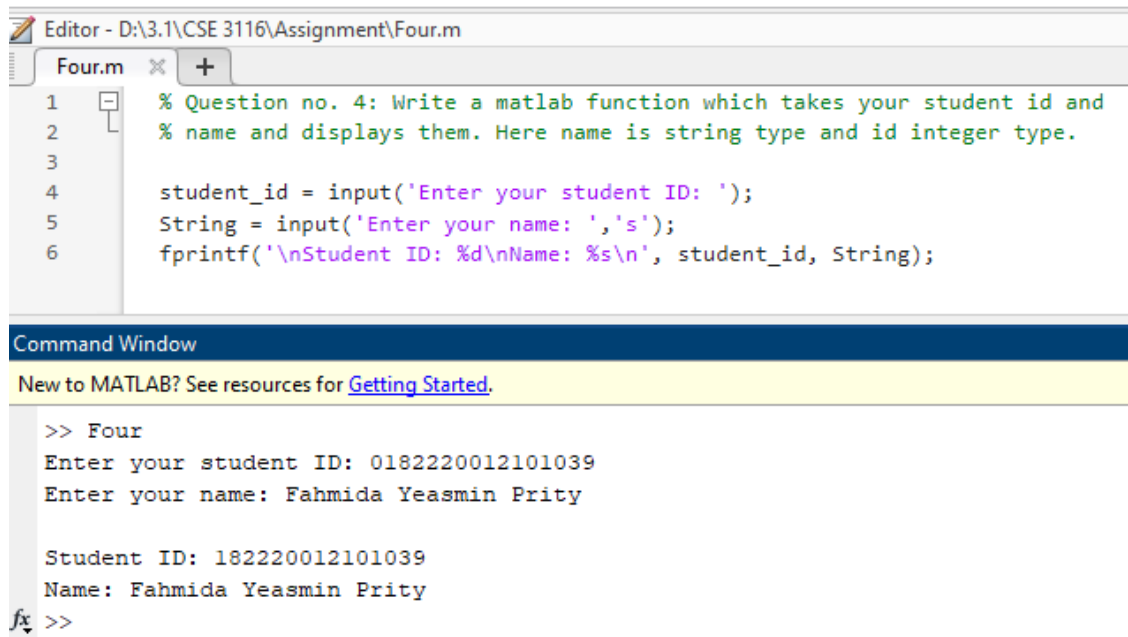
```
Editor - D:\3.1\CSE 3116\Assignment\Three.m
Three.m
1 % Question no. 3: Write a matlab code which takes integer n as input and
2 % outputs the full multiplication table of n using while loop.
3
4 n = input('Enter an integer for the multiplication table: ');
5 i = 1;
6 while i<=10
7     product = n*i;
8     fprintf('%d X %d = %d\n', n, i, product);
9     i = i+1;
10 end

Command Window
New to MATLAB? See resources for Getting Started.

>> Three
Enter an integer for the multiplication table: 3
3 X 1 = 3
3 X 2 = 6
3 X 3 = 9
3 X 4 = 12
3 X 5 = 15
3 X 6 = 18
3 X 7 = 21
3 X 8 = 24
3 X 9 = 27
3 X 10 = 30
fx >> |
```

Problem 4: Write a MATLAB function which takes your student id and name and displays them. Here name is string type and id integer type.

The code and output:



The image shows a MATLAB Editor window with a file named 'Four.m'. The code in the editor is as follows:

```
1 % Question no. 4: Write a matlab function which takes your student id and
2 % name and displays them. Here name is string type and id integer type.
3
4 student_id = input('Enter your student ID: ');
5 String = input('Enter your name: ','s');
6 fprintf('\nStudent ID: %d\nName: %s\n', student_id, String);
```

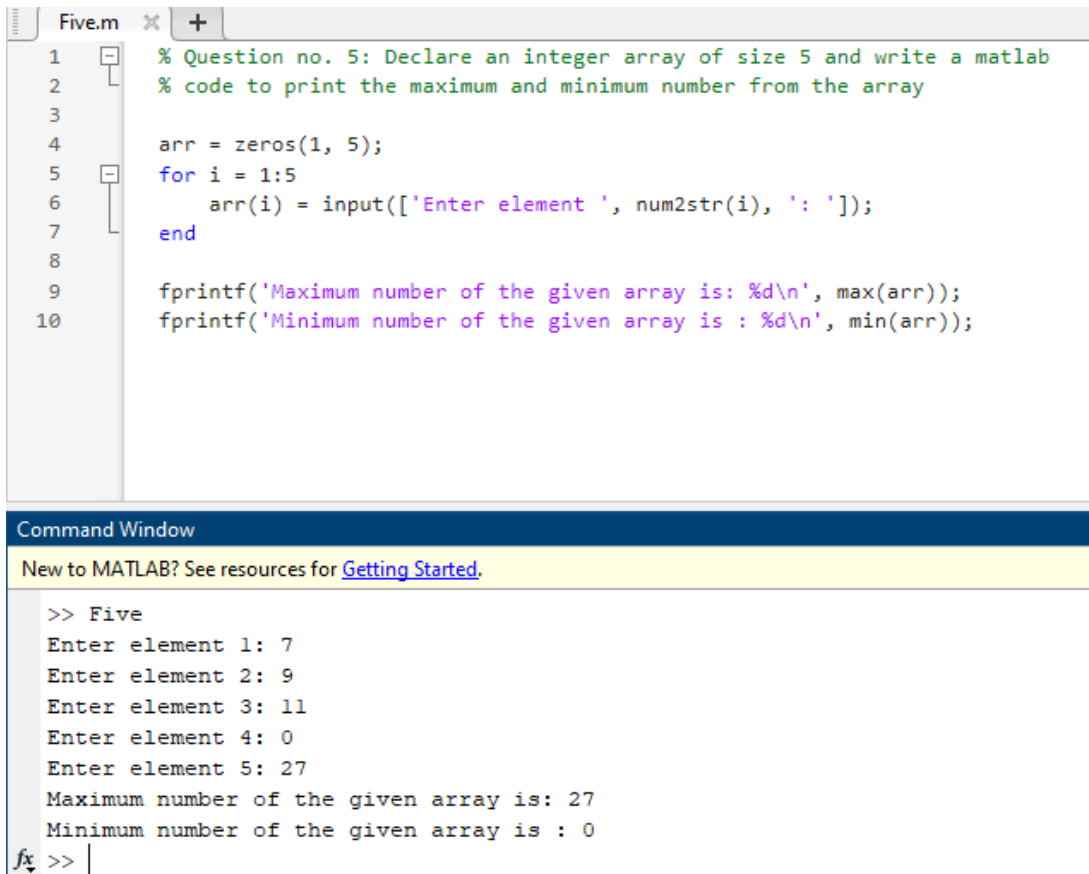
Below the editor is the Command Window. It shows the execution of the script 'Four'. The user is prompted to enter a student ID and a name. The output displays the entered values.

```
>> Four
Enter your student ID: 0182220012101039
Enter your name: Fahmida Yeasmin Prity

Student ID: 182220012101039
Name: Fahmida Yeasmin Prity
fx >>
```

Problem 5: Declare an integer array of size 5 and write a MATLAB code to print the maximum and minimum number from the array.

The code and output:



The image shows a MATLAB Editor window with a file named 'Five.m'. The code in the editor is as follows:

```
1 % Question no. 5: Declare an integer array of size 5 and write a matlab
2 % code to print the maximum and minimum number from the array
3
4 arr = zeros(1, 5);
5 for i = 1:5
6     arr(i) = input(['Enter element ', num2str(i), ': ']);
7 end
8
9 fprintf('Maximum number of the given array is: %d\n', max(arr));
10 fprintf('Minimum number of the given array is : %d\n', min(arr));
```

Below the editor is the Command Window. It shows the execution of the script 'Five'. The user is prompted to enter five elements. The output displays the maximum and minimum values of the array.

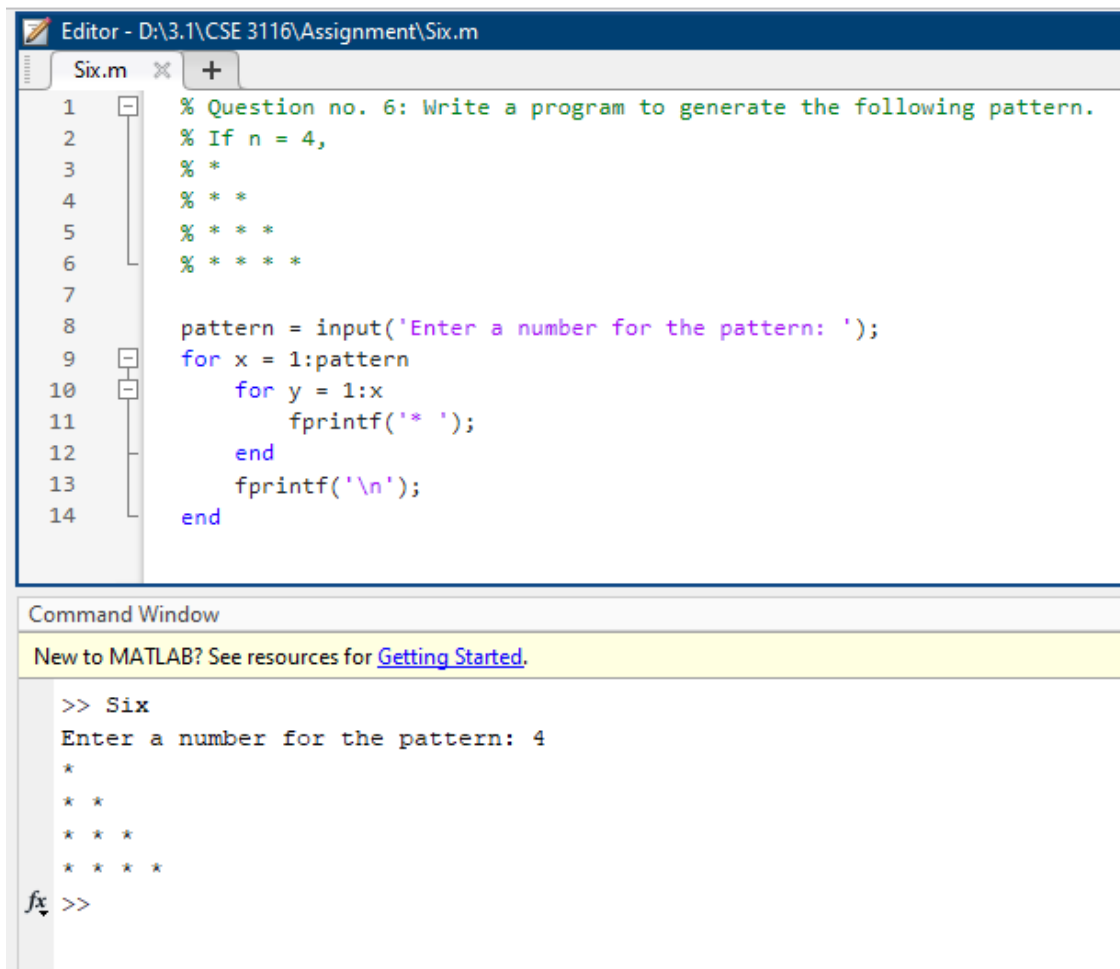
```
>> Five
Enter element 1: 7
Enter element 2: 9
Enter element 3: 11
Enter element 4: 0
Enter element 5: 27
Maximum number of the given array is: 27
Minimum number of the given array is : 0
fx >> |
```

Problem 6: Write a program to generate the following pattern.

If $n = 4$,

```
*  
* *  
* * *  
* * * *
```

The code and output:



The image shows a MATLAB Editor window titled "Editor - D:\3.1\CSE 3116\Assignment\Six.m" and a Command Window below it. The Editor window contains the following code:

```
1 % Question no. 6: Write a program to generate the following pattern.  
2 % If n = 4,  
3 % *  
4 % * *  
5 % * * *  
6 % * * * *  
7  
8 pattern = input('Enter a number for the pattern: ');  
9 for x = 1:pattern  
10     for y = 1:x  
11         fprintf('* ');  
12     end  
13     fprintf('\n');  
14 end
```

The Command Window shows the execution of the script:

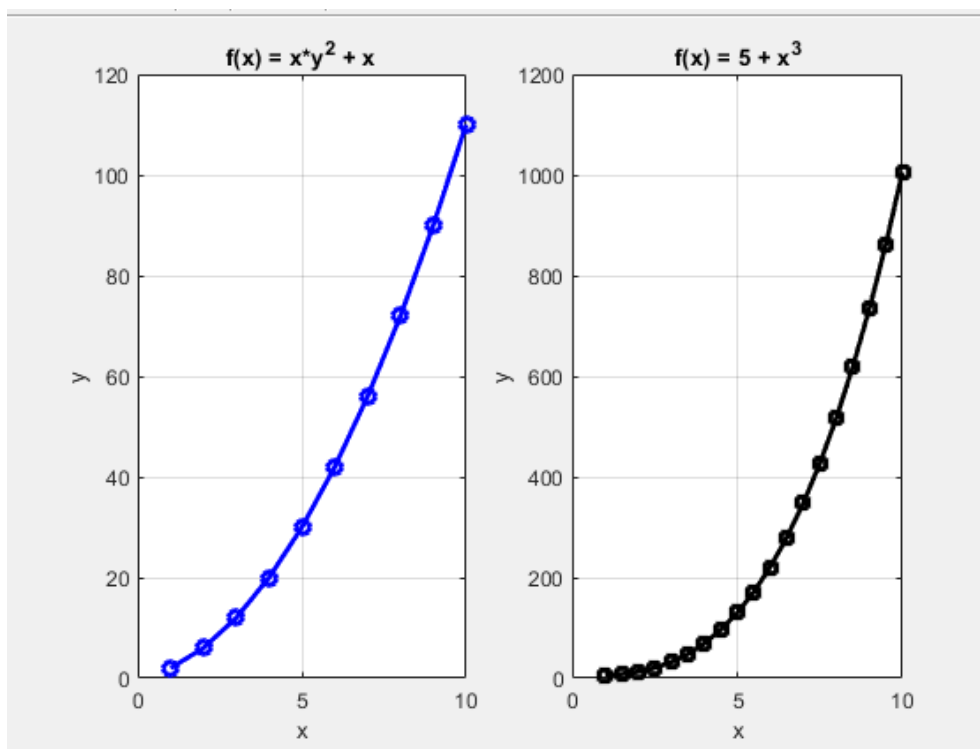
```
>> Six  
Enter a number for the pattern: 4  
*  
* *  
* * *  
* * * *  
fx >>
```

Problem 7: Declare the following functions and plot the functions for $x = 1$ to 10 using interval 1 for first function and 0.5 for second function. Use subplot, plot first function in 1st column and second in 2nd column.

- i. $f(x, y) = xy^2 + x$
- ii. $f(x) = 5 + x^3$

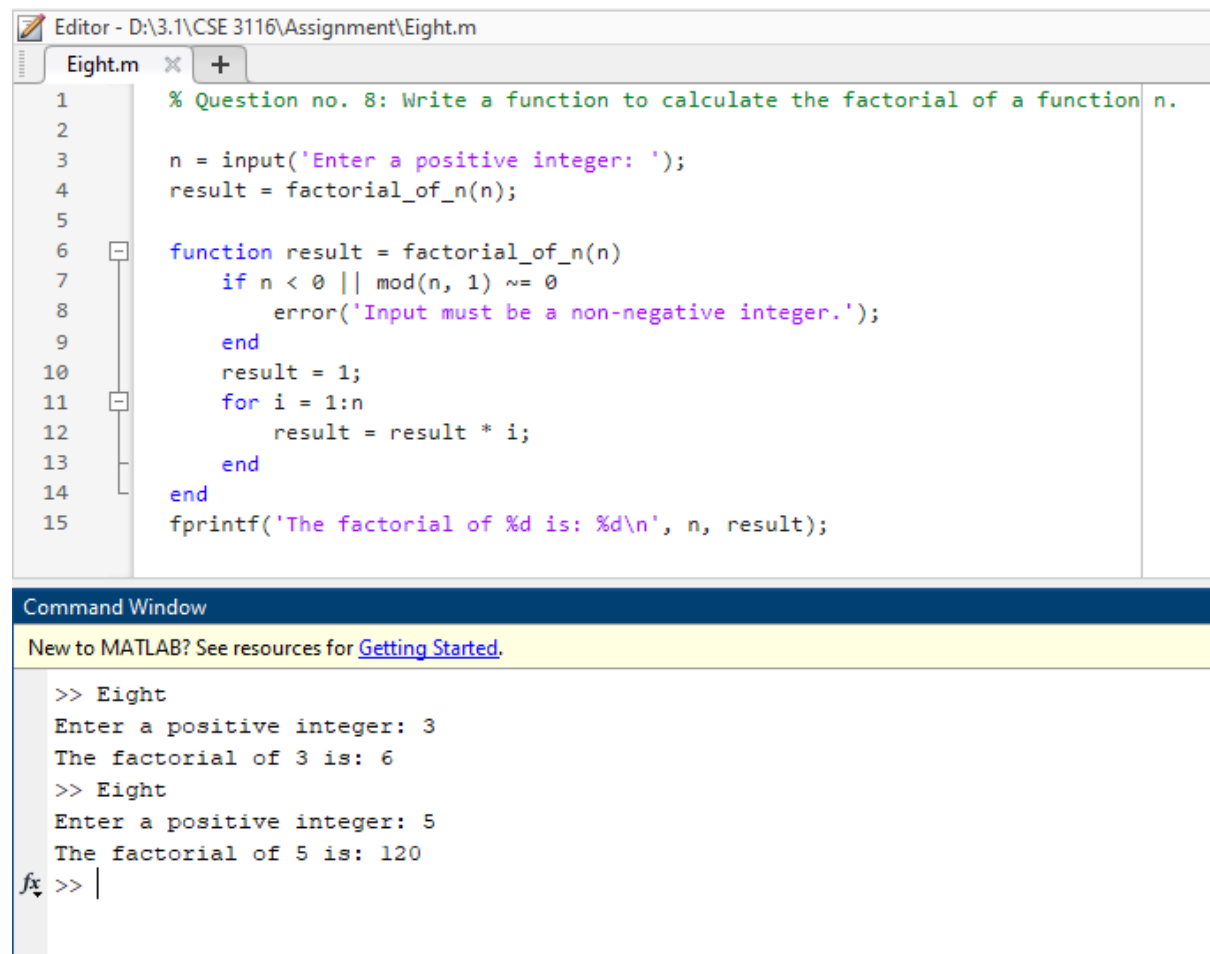
The code and output:

```
Seven.m x +
1 % Question no. 7: Declare the following functions and plot the functions
2 % for x = 1 to 10 using interval 1 for first function and 0.5 for second
3 % function. Use subplot, plot first function in 1st column and second in
4 % 2nd column.
5 % f (x, y) = x*y^2 + x
6 % f(x) = 5 + x^3
7
8 x1 = 1:1:10;
9 x2 = 1:0.5:10;
10 y1 = x1.^2 + x1;
11 y2 = 5 + x2.^3;
12
13 subplot(1, 2, 1);
14 plot(x1, y1, '-o', 'LineWidth', 2, 'Color', 'b');
15 title('f(x) = x*y^2 + x');
16 xlabel('x');
17 ylabel('y');
18 grid on;
19
20 subplot(1, 2, 2);
21 plot(x2, y2, '-s', 'LineWidth', 2, 'Color', 'k');
22 title('f(x) = 5 + x^3');
23 xlabel('x');
24 ylabel('y');
25 grid on;
```



Problem 8: Write a function to calculate the factorial of a function n.

The code and output:



The image shows a MATLAB environment with two windows. The top window is the 'Editor' showing a script named 'Eight.m'. The script contains a function 'factorial_of_n' that calculates the factorial of a non-negative integer 'n'. The bottom window is the 'Command Window' showing the execution of the script. It prompts the user to enter a positive integer, and the script outputs the factorial for the entered values (3 and 5).

```
Editor - D:\3.1\CSE 3116\Assignment\Eight.m
Eight.m
1 % Question no. 8: Write a function to calculate the factorial of a function n.
2
3 n = input('Enter a positive integer: ');
4 result = factorial_of_n(n);
5
6 function result = factorial_of_n(n)
7     if n < 0 || mod(n, 1) ~= 0
8         error('Input must be a non-negative integer.');
```

```
Command Window
New to MATLAB? See resources for Getting Started.

>> Eight
Enter a positive integer: 3
The factorial of 3 is: 6
>> Eight
Enter a positive integer: 5
The factorial of 5 is: 120
fx >> |
```


Problem 9: Determine the root of the function $f(x) = x^3 - 2x + 1$ using Bisection, False-Position, Fixed-Point Iteration, Newton-Raphson and Secant method correct to 2 decimal places. If the solution doesn't converge within five iterations, then limit the iteration number to 5.

The codes and outputs:

a) Bisection Method:

```
Editor - D:\3.1\CSE 3116\Assignment\Nine.m
Nine.m
1 % Question no. 9: Determine the root of the function f(x) = x^3 - 2*x + 1 using
2 % Bisection, False-Position, Fixed-Point Iteration, Newton-Raphson and Secant method
3 % correct to 2 decimal places. If the solution doesn't converge within five iterations
4 % then limit the iteration number to 5.
5
6 % Bisection Method
7 f = @(x) x^3 - 2*x + 1;
8 l = input('Enter x1: ');
9 u = input('Enter a xu: ');
10 n = 5;
11 t = 0.05;
12 if f(l)*f(u)<0
13     for i=1:n
14         r = (l+u)/2;
15         fprintf('Iteration %d = %.2f\n', i, r);
16         if abs(r-u)<t || abs(r-l)<t
17             break;
18         end
19         if f(r)<0
20             l=r;
21         elseif f(r)>0
22             u=r;
23         end
24     end
25 else
26     disp('Not applicable.\n');
27 end
28
```

```
Command Window
New to MATLAB? See resources for Getting Started.

>> Nine
Enter x1: -2
Enter a xu: -1
Iteration 1 = -1.50
Iteration 2 = -1.75
Iteration 3 = -1.62
Iteration 4 = -1.56
Iteration 5 = -1.59
fx >>
```

b) False-Position Method:

```
Editor - D:\3.1\CSE 3116\Assignment\Nine.m *
Nine.m *
1 % Question no. 9: Determine the root of the function f(x) = x^3 - 2*x + 1 using
2 % Bisection, False-Position, Fixed-Point Iteration, Newton-Raphson and Secant method
3 % correct to 2 decimal places. If the solution doesn't converge within five iterations
4 % then limit the iteration number to 5.
5
6 % False Position Method
7 f = @(x) x^3 - 2*x + 1;
8 l = input('Enter x1: ');
9 u = input('Enter a xu: ');
10 n = 5;
11 t = 0.005;
12 if f(l)*f(u)<0
13     for i=1:n
14         r=u-((f(u)*(1-u))/(f(1)-f(u)));
15         fprintf('Iteration %d = %.2f\n', i, r);
16         if abs(r-u)<t || abs(r-l)<t
17             break;
18         end
19         if f(r)<0
20             l=r;
21         elseif f(r)>0
22             u=r;
23         end
24     end
25 else
26     disp('Not applicable.\n');
27 end
```

Command Window

New to MATLAB? See resources for [Getting Started](#).

```
>> Nine
Enter x1: -2
Enter a xu: -1
Iteration 1 = -1.40
Iteration 2 = -1.56
Iteration 3 = -1.60
Iteration 4 = -1.61
Iteration 5 = -1.62
fx >>
```

c) Fixed-Point Iteration:

```

1 % Question no. 9: Determine the root of the function f(x) = x^3 - 2*x + 1 using
2 % Bisection, False-Position, Fixed-Point Iteration, Newton-Raphson and Secant method
3 % correct to 2 decimal places. If the solution doesn't converge within five iterations
4 % then limit the iteration number to 5.
5
6 % Fixed Point Iteration Method
7 g = input('Enter a function: ');
8 x0 = input('Enter x: ');
9 n = 5;
10 t = 0.001;
11 for i = 1:n
12     x1 = g(x0);
13     fprintf('Iteration %d = %.2f\n', i, x1);
14     if abs(x1 - x0) < t
15         break;
16     end
17     x0 = x1;
18 end

```

Command Window

New to MATLAB? See resources for [Getting Started](#).

```

>> Nine
Enter a function: @(x) (x^3 + 1)/2
Enter x: 0.5
Iteration 1 = 0.56
Iteration 2 = 0.59
Iteration 3 = 0.60
Iteration 4 = 0.61
Iteration 5 = 0.61
fx >>

```

d) Newton-Raphson Method:

```

1 % Question no. 9: Determine the root of the function f(x) = x^3 - 2*x + 1 using
2 % Bisection, False-Position, Fixed-Point Iteration, Newton-Raphson and Secant method
3 % correct to 2 decimal places. If the solution doesn't converge within five iterations
4 % then limit the iteration number to 5.
5
6 % Newton-Raphson Method
7 f = input('Enter a function: ');
8 Df = input('Enter the derivative of the function: ');
9 x0 = input('Enter x0: ');
10 n = 5;
11 t = 0.001;
12 for i = 1:n
13     x1 = x0 - (f(x0) / Df(x0));
14     fprintf('Iteration %d = %.2f\n', i, x1);
15     if abs(x1 - x0) < t
16         break
17     end
18     x0 = x1;
19 end
20
```

Command Window

New to MATLAB? See resources for [Getting Started](#).

```
>> Nine
Enter a function: @(x) x^3 - 2*x +1
Enter the derivative of the function: @(x) 3*x^2 - 2
Enter x0: -2
Iteration 1 = -1.70
Iteration 2 = -1.62
Iteration 3 = -1.62
Iteration 4 = -1.62
```

e) The Secant Method:

```
Nine.m
1 % Question no. 9: Determine the root of the function  $f(x) = x^3 - 2x + 1$  using
2 % Bisection, False-Position, Fixed-Point Iteration, Newton-Raphson and Secant method
3 % correct to 2 decimal places. If the solution doesn't converge within five iteration:
4 % then limit the iteration number to 5.
5
6 % The Secant Method
7 f = input('Enter a function: ');
8 x0 = input('Enter x0: ');
9 x1 = input('Enter x1: ');
10 n = 5;
11 t = 0.001;
12 for i = 1:n
13     x2 = x1 - ( (f(x1)*(x0-x1)) / (f(x0)-f(x1)) );
14     fprintf('Iteration %d = %.2f\n', i, x2);
15     if abs(x2 - x1) < t
16         break
17     end
18     x0 = x1;
19     x1 = x2;
20 end
```

Command Window

```
>> Nine
Enter a function: @(x) x^3 - 2*x + 1
Enter x0: -2
Enter x1: -1
Iteration 1 = -1.40
Iteration 2 = -1.85
Iteration 3 = -1.58
Iteration 4 = -1.61
Iteration 5 = -1.62
fx >> |
```

Problem 10: Find the solution of the following set of linear equations using Cramer's rule.

$$2x + 5y = 8$$

$$3x - y = 4$$

The code and output:

```
Ten.m
1 % Question no. 10: Find the solution of the following set of linear equations
2 % using Cramer's rule. 2x + 5y = 8, 3x - y = 4
3
4 a = input('Enter co-efficient matrix: ');
5 b = input('Enter constant: ');
6 n = length(b);
7 un = zeros(n, 1); % Unknown Variable
8 d = det(a);
9 aprev = a;
10 if d ~= 0
11     for i = 1:n
12         a(:,i) = b;
13         un(i) = det(a)/d;
14         a = aprev;
15     end
16     un
17 else
18     disp('Not applicable.\n');
19 end
```

Command Window

New to MATLAB? See resources for [Getting Started](#).

```
>> Ten
Enter co-efficient matrix: [2,5;3,-1]
Enter constant: [8,4]

a =

     2     5
     3    -1

a =

     2     8
     3     4

un =

    1.6471
    0.9412
```