Symbiosis University of Applied Sciences, Indore

India's First Skill University

SKILL JOURNAL

Enrollment Number – 2019BTCS088 Year of Enrollment – 2019-2023

Name of the Student – YASH GUPTA

School of COMPUTER SCIENCE & INFORMATION TECHNOLOGY

Program – B. TECH

Specialization/ Branch – CS&IT

Semester – 4TH Section – B2 Branch – CS&IT

Paper Code – BTCS04CFB2 Name of Paper – Statistics-II

Faculty-In-Charge – DEVENDRA CHOUHAN SIR

CERTIFICATE

THE SKILL EXPERIMENTS

ENTERED IN THIS JOURNAL HAVE BEEN SATISFACTORY PERFORMED BY

ENROLLMENT NO - 2019BTCS088 MR/MS YASH GUPTA

STUDYING IN PROGRAM B. TECH BRANCH CS&IT IN

SCHOOL OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

DURING SEMESTER 4^{TH} OF ACADEMIC YEAR 2020-2021

_____

( )

Date: _____

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S.NO	Title of Skill Activity	Date of Allocation	Date of Submission	Sign of Faculty
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2.	Standard Deviation for all 3 types of Series using MATLAB	17/06/2021	18/06/2021	
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4.	Application of Curve-Fitting for Real world Problems	17/06/2021	25/06/2021	
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SKILL ACTIVITIY NO: 1

(Mean Deviation about Mean Median Mode for all 3 types of Series with MATLAB)

Date: 15th June 2021

SKILL ACTIVITY-01

Date: 15th June 2021

TITLE: Mean Deviation ~~about~~ from Mean, Median, Mode for all 3 types of series using MATLAB

1. What is the purpose of this Activity? (Explain in 3-4 lines)

Purpose of this Activity is to find out:-

- ⓐ What is Mean-Deviation? Why we need it?
- ⓑ Need of Mean-Deviation in Real world use-cases.
- ⓒ How to find Mean Deviation?
- ⓓ How to find mean-deviation ~~about~~ from all 3 central tendency values along with for all 3 types of Series.

2. Steps performed in this Activity? (Explain in 5-6 lines)

Ⓐ For finding Mean Deviation ~~from~~ from Mean

(a) Individual Series

- Step① Store the dataset in the variable 'x'.
- Step② Find the mean using mean() of Matlab.
- Step③ Find the absolute of ~~mean~~ X-Mean i.e Absolute Deviation from mean (i.e. $|X-\bar{X}|$)
- Step④ Find the sum of Absolute Deviation from Mean
- Step⑤ Use below formula to find Mean Deviation i.e

$$M.D = \frac{\Sigma |X-\bar{X}|}{n}$$ ← Total No. of observations in 'x'

~~Ⓑ for finding Mean Deviation for~~

(b) Discrete Series

- Step①: Here, we have provided respective frequency of each observation.
- Step②: So first we will find product of frequency & 'x' & find sum of it.
- Step③ Find the Absolute Deviation from Mean i.e $|X-\bar{X}|$
- Step④ Multiply frequency with the Abs. Deviation from Mean.
- Step⑤ Find sum of above product.
- Step⑥ Use below formula to find Mean Deviation i.e.

$$M.D = \frac{\Sigma f |X-\bar{X}|}{\Sigma f.}$$ ← Sum of frequencies of all observations

(c) **Continuous Series**

↳ Here, class intervals are provided in question with their corresponding frequencies. So

Step① → First find out the MID-POINT (value) from class interval using $\frac{(\text{Upper limit} + \text{Lower limit})}{2}$ = Mid value

Step② → Now, store the Mid values as "X" & their respective frequencies as "f"

Step③ → Find the Absolute Deviation from mean i.e. $|X - \bar{X}|$

Step④ → Multiply frequency with Absolute Deviation ~~from~~ About Mean.

Step⑤ → Find sum of above product.

Step⑥ → Use Below formula to find Mean Deviation i.e.

$$M.D = \frac{\sum_{i=1}^{n} f_i |x_i - \bar{x}|}{\sum_{i=1}^{n} f_i}$$

$\sum_{i=1}^{n} f_i$ → Sum of frequencies of all observations.

(b) For finding Mean Deviation From Median

(a) **Individual Series**

↳ Step① Store the dataset in the variable "X"

↳ Step② Arrange the dataset in any order. (using sort())

↳ Step③ Find median using median().

↳ Step④ Find the Absolute Deviation from Median i.e. $|X - \text{Median}|$

↳ Step⑤ Find the sum of Absolute Deviation from Median.

↳ Step⑥ Use below formula to find Mean Deviation abt Median i.e.

$$M.D = \frac{\sum |X - \text{Median}|}{n}$$

(b) **Discrete Series**

↳ Step① Here we have provided respective frequency of each observation.

↳ Step② First arrange the dataset in definite order along with frequency. using sort()

↳ Step③ Then find cummulative frequency. (c.f) using cumsum()

↳ Step④ Find the median using mathematical formula according to the length of "X".

$$M.D = \frac{\sum f_i |X - \text{Median}|}{\sum f_i}$$

(c) **Continuous Series** → Here class intervals are given with their corresponding frequencies.

- Step① First find the cummulative frequency (c.f) using cumsum(). & also find the mid-value of 'x' from class interval.
- Step② Find the median term using formula $\Rightarrow \left(\frac{\Sigma f}{2}\right)$
- Step③ From above step we get our Median class.
- Step④: Now apply Mathematical Formula, & find out Median

$$\text{Median} = l + \frac{\left(\frac{N}{2} - c.f\right)}{f} * h$$

- Step⑤ Now perform all the same steps we done in Discrete series..

(c) For finding Mean Deviation from Mode

a. **Individual Series**

- Step①: Store the dataset (x) in one variable.
- Step②: Find the mode of 'x' using mode().
- Step③ Then find the Absolute Deviation about mode using $|x - \text{Mode}(x)|$
- Step④: Find the sum of Absolute Deviation about mode by using sum(.) function.
- Step⑤: Use below formula to find Mean Deviation i.e.

$$M.D = \frac{\Sigma |x - \text{Mode}(x)|}{n}$$

n ← Total No. of observations in 'x'

b. **Discrete Series**

- Step①: Here, we have provided respective frequency of each observation.
- Step②: Concat both of the array's i.e. 'x' and 'f' into one array.
- Step③: Find mode by performing one MATLAB operation on the concated array, ie.

Array = (X(X(:,2) == max(X(:,2)),1)

- Step④ Find the Absolute Deviation about mode.
- Step⑤ Find sum of Abs. Deviation ——— & multiply with freq wrt x
- Step⑥ Use below formula to find Mean Deviation i.e.

$$M.D = \frac{\Sigma f_i |x - \text{Mode}(x)|}{\Sigma f_i}$$

c. **Continuous Series**

↳ step①: Here, Class Intervals are provided in question with their corresponding frequencies.

↳ step①: First find out the MID-Value from class interval using
Mid-value = (Upper_limit + lower_limit)/2.

↳ step②: Store the mid values as 'x' & their respective frequencies as 'f'

↳ step③: Finding the Modal Class by finding Highest frequency using same operation we done in Discrete Series.

↳ step④: Find the mode using mathematical formula

↳ $\text{Mode} = L + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) * h$

↳ step⑤: Find Absolute deviation about mode using
$|x - \text{Mode}(x)|$

↳ step⑥: Finding sum of Absolute Devio' abt Mode.
using sum()

↳ step⑦: Use below formula to find Mean Deviation i.e.

$$M.D = \frac{\sum f_i |x - \text{Mode}(x)|}{\sum f_i}$$

3. What Resources/Equipments/Tools/Materials did you use for this activity?
   a. Matlab 30 Days Trial software (2020b)
   b. Matlab online Help Documentation

4. What skills did you acquire?
   ↳ Get to know about what, why, when to use Mean Deviation?
   ↳ Application of Mean Deviation
   ↳ How to create code in MATLAB for mean deviation abt Mean, Median, Mode
   ↳ Use of mean(), median(), mode(), function.

5. Time taken to complete this Activity? 03:00 (HOURS)

Yogesh

Signature of Student

———×———

(To be filled by Faculty)

Sr. No.	Skill /Competencies	(Achieved / Not Achieved) (Yes / No)

Remarks :

Total mark _____out of 10.

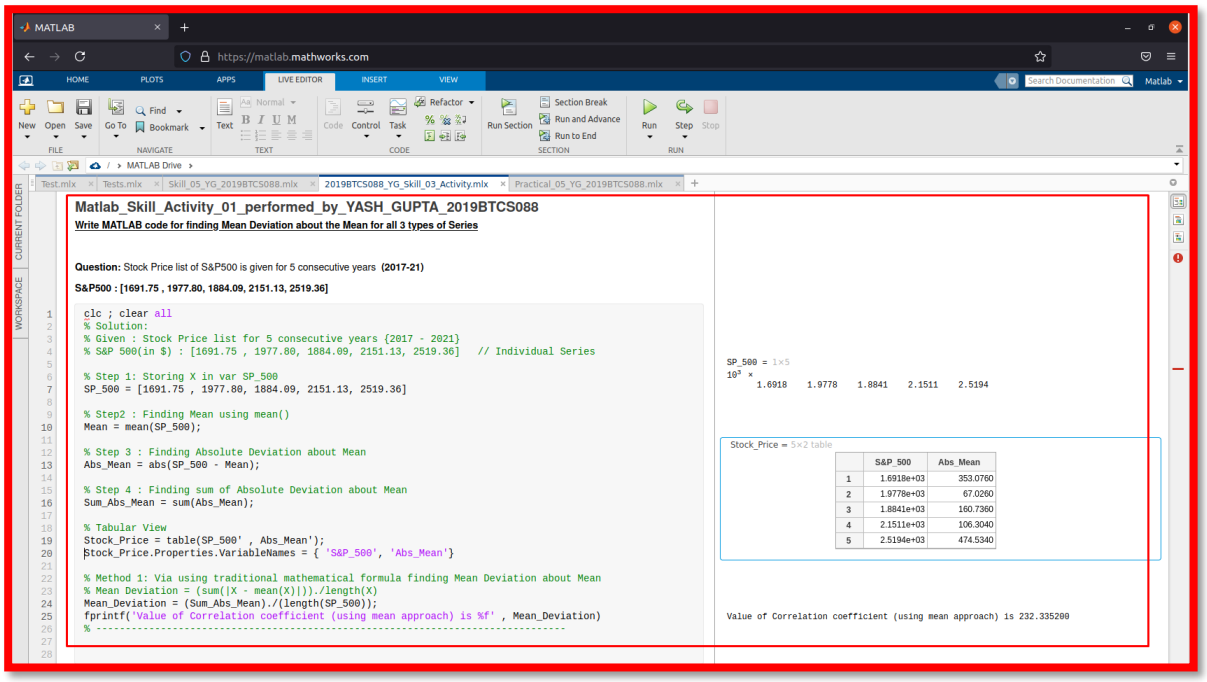
Signature of Faculty

Date: _____

Details of Activity:

MATLAB CODE:

A. Example 1: Mean Deviation about Mean for Individual Series



Matlab_Skill_Activity_01_performed_by_YASH_GUPTA_2019BTCS088

Write MATLAB code for finding Mean Deviation about the Mean for all 3 types of Series

Question: Stock Price list of S&P500 is given for 5 consecutive years **(2017-21)**

S&P500 : [1691.75 , 1977.80, 1884.09, 2151.13, 2519.36]

```
clc ; clear all
% Solution:
% Given : Stock Price list for 5 consecutive years {2017 - 2021}
% S&P 500(in $) : [1691.75 , 1977.80, 1884.09, 2151.13, 2519.36]   // Individual Series

% Step 1: Storing X in var SP_500
SP_500 = [1691.75 , 1977.80, 1884.09, 2151.13, 2519.36]

% Step2 : Finding Mean using mean()
Mean = mean(SP_500);

% Step 3 : Finding Absolute Deviation about Mean
Abs_Mean = abs(SP_500 - Mean);

% Step 4 : Finding sum of Absolute Deviation about Mean
Sum_Abs_Mean = sum(Abs_Mean);

% Tabular View
Stock_Price = table(SP_500' , Abs_Mean');
Stock_Price.Properties.VariableNames = { 'S&P_500', 'Abs_Mean'}

% Method 1: Via using traditional mathematical formula finding Mean Deviation about Mean
% Mean Deviation = (sum(|X - mean(X)|))./length(X)
Mean_Deviation = (Sum_Abs_Mean)./(length(SP_500));
fprintf('Value of Correlation coefficient (using mean approach) is %f' , Mean_Deviation)
% ------------------------------------------------------------------------
```

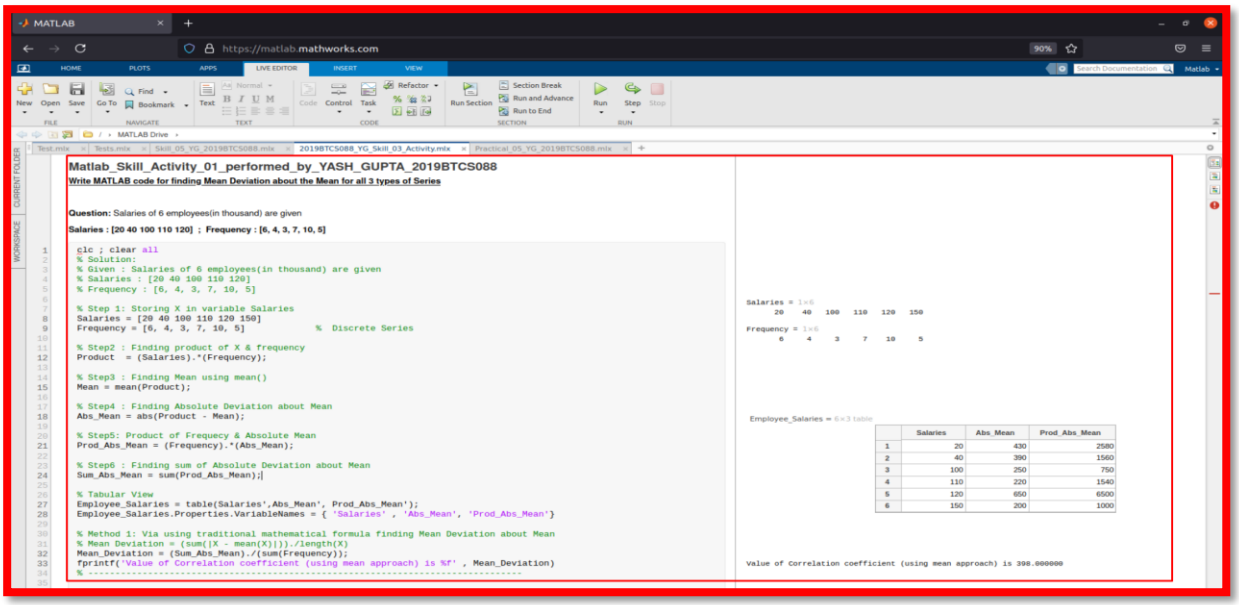
```
SP_500 = 1×5
10^3 ×
    1.6918    1.9778    1.8841    2.1511    2.5194
```

Stock_Price = 5×2 table

	S&P_500	Abs_Mean
1	1.6918e+03	353.0760
2	1.9778e+03	67.0260
3	1.8841e+03	160.7360
4	2.1511e+03	106.3040
5	2.5194e+03	474.5340

```
Value of Correlation coefficient (using mean approach) is 232.335200
```

B. Example 2: Mean Deviation about Mean for Discrete Series



Matlab_Skill_Activity_01_performed_by_YASH_GUPTA_2019BTCS088

Write MATLAB code for finding Mean Deviation about the Mean for all 3 types of Series

Question: Salaries of 6 employees(in thousand) are given

Salaries : [20 40 100 110 120] ; Frequency : [6, 4, 3, 7, 10, 5]

```
clc ; clear all
% Solution:
% Given : Salaries of 6 employees(in thousand) are given
% Salaries : [20 40 100 110 120]
% Frequency : [6, 4, 3, 7, 10, 5]

% Step 1: Storing X in variable Salaries
Salaries = [20 40 100 110 120 150]
Frequency = [6, 4, 3, 7, 10, 5]            %  Discrete Series

% Step2 : Finding product of X & frequency
Product  = (Salaries).*(Frequency);

% Step3 : Finding Mean using mean()
Mean = mean(Product);

% Step4 : Finding Absolute Deviation about Mean
Abs_Mean = abs(Product - Mean);

% Step5: Product of Frequecy & Absolute Mean
Prod_Abs_Mean = (Frequency).*(Abs_Mean);

% Step6 : Finding sum of Absolute Deviation about Mean
Sum_Abs_Mean = sum(Prod_Abs_Mean);

% Tabular View
Employee_Salaries = table(Salaries',Abs_Mean', Prod_Abs_Mean');
Employee_Salaries.Properties.VariableNames = { 'Salaries' , 'Abs_Mean', 'Prod_Abs_Mean'}

% Method 1: Via using traditional mathematical formula finding Mean Deviation about Mean
% Mean Deviation = (sum(|X - mean(X)|))./length(X)
Mean_Deviation = (Sum_Abs_Mean)./(sum(Frequency));
fprintf('Value of Correlation coefficient (using mean approach) is %f' , Mean_Deviation)
% ------------------------------------------------------------------------
```

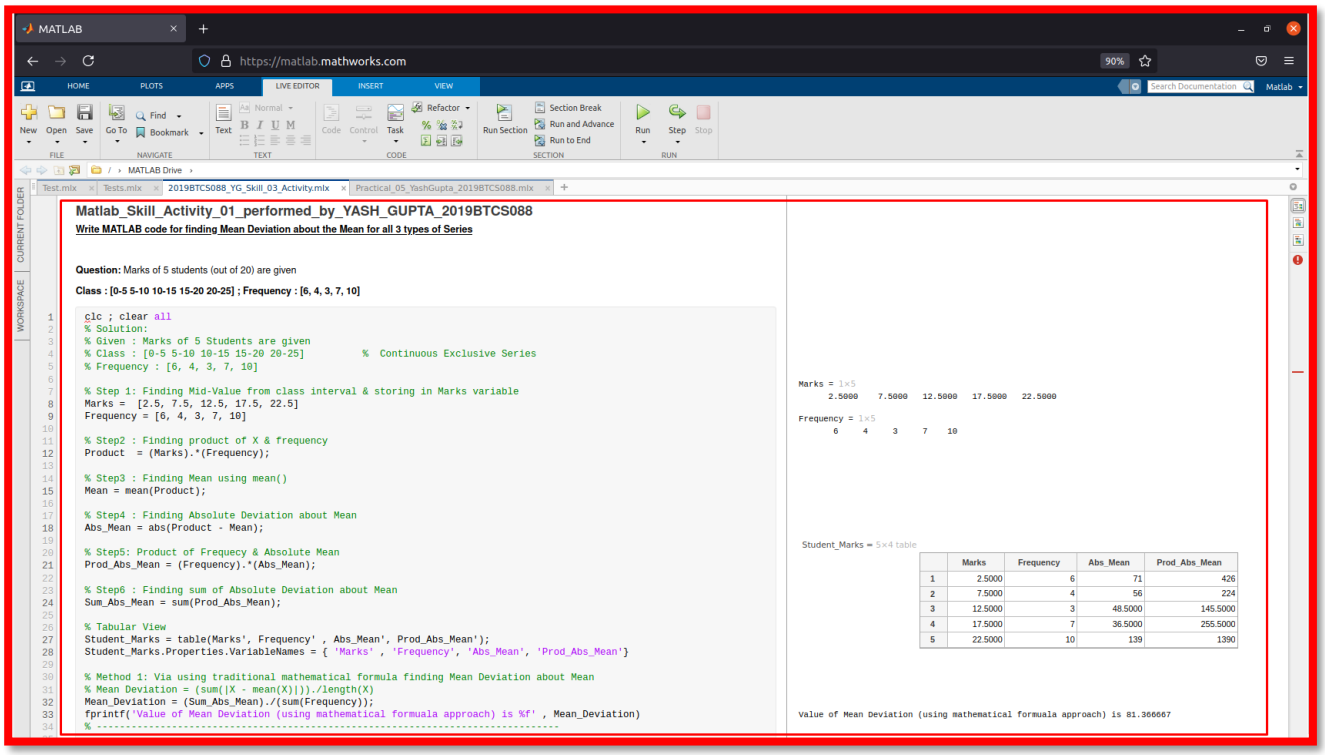
```
Salaries = 1×6
    20    40   100   110   120   150
Frequency = 1×6
     6     4     3     7    10     5
```

Employee_Salaries = 6×3 table

	Salaries	Abs_Mean	Prod_Abs_Mean
1	20	430	2580
2	40	390	1560
3	100	250	750
4	110	220	1540
5	120	650	6500
6	150	200	1000

```
Value of Correlation coefficient (using mean approach) is 398.000000
```

C. Example 3: Mean Deviation about Mean for Continuous Series



Matlab_Skill_Activity_01_performed_by_YASH_GUPTA_2019BTCS088

Write MATLAB code for finding Mean Deviation about the Mean for all 3 types of Series

Question: Marks of 5 students (out of 20) are given

Class : [0-5 5-10 10-15 15-20 20-25] ; Frequency : [6, 4, 3, 7, 10]

```
clc ; clear all
% Solution:
% Given : Marks of 5 Students are given
% Class : [0-5 5-10 10-15 15-20 20-25]          %  Continuous Exclusive Series
% Frequency : [6, 4, 3, 7, 10]

% Step 1: Finding Mid-Value from class interval & storing in Marks variable
Marks =  [2.5, 7.5, 12.5, 17.5, 22.5]
Frequency = [6, 4, 3, 7, 10]

% Step2 : Finding product of X & frequency
Product  = (Marks).*(Frequency);

% Step3 : Finding Mean using mean()
Mean = mean(Product);

% Step4 : Finding Absolute Deviation about Mean
Abs_Mean = abs(Product - Mean);

% Step5: Product of Frequecy & Absolute Mean
Prod_Abs_Mean = (Frequency).*(Abs_Mean);

% Step6 : Finding sum of Absolute Deviation about Mean
Sum_Abs_Mean = sum(Prod_Abs_Mean);

% Tabular View
Student_Marks = table(Marks', Frequency' , Abs_Mean', Prod_Abs_Mean');
Student_Marks.Properties.VariableNames = { 'Marks' , 'Frequency', 'Abs_Mean', 'Prod_Abs_Mean'}

% Method 1: Via using traditional mathematical formula finding Mean Deviation about Mean
% Mean Deviation = (sum(|X - mean(X)|))./length(X)
Mean_Deviation = (Sum_Abs_Mean)./(sum(Frequency));
fprintf('Value of Mean Deviation (using mathematical formula approach) is %f' , Mean_Deviation)
% --------------------------------------------------------------------------------
```

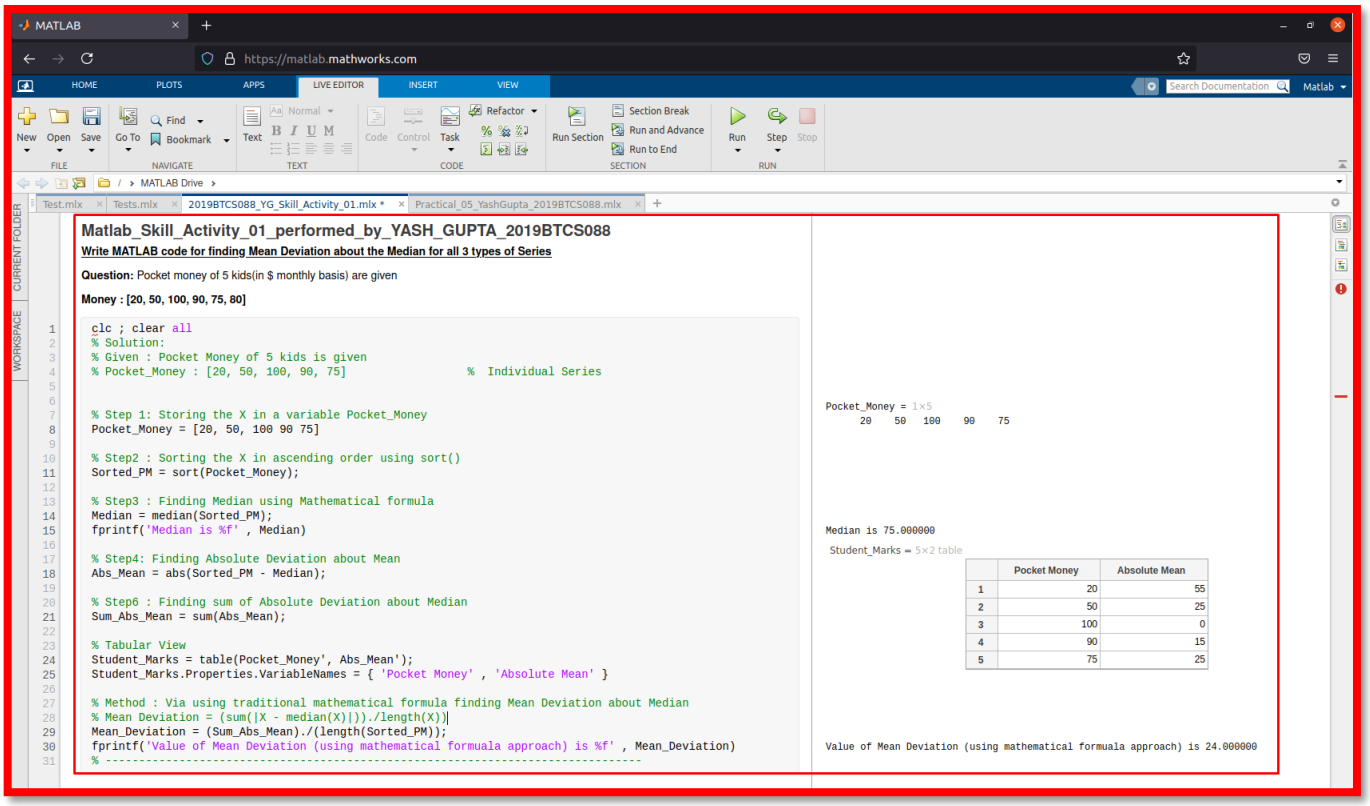
```
Marks = 1×5
    2.5000    7.5000   12.5000   17.5000   22.5000

Frequency = 1×5
     6     4     3     7    10
```

Student_Marks = 5×4 table

	Marks	Frequency	Abs_Mean	Prod_Abs_Mean
1	2.5000	6	71	426
2	7.5000	4	56	224
3	12.5000	3	48.5000	145.5000
4	17.5000	7	36.5000	255.5000
5	22.5000	10	139	1390

```
Value of Mean Deviation (using mathematical formula approach) is 81.366667
```

D. Example 1: Mean Deviation about Median for Individual Series



Matlab_Skill_Activity_01_performed_by_YASH_GUPTA_2019BTCS088

Write MATLAB code for finding Mean Deviation about the Median for all 3 types of Series

Question: Pocket money of 5 kids(in $ monthly basis) are given

Money : [20, 50, 100, 90, 75, 80]

```
clc ; clear all
% Solution:
% Given : Pocket Money of 5 kids is given
% Pocket_Money : [20, 50, 100, 90, 75]                %  Individual Series


% Step 1: Storing the X in a variable Pocket_Money
Pocket_Money = [20, 50, 100 90 75]

% Step2 : Sorting the X in ascending order using sort()
Sorted_PM = sort(Pocket_Money);

% Step3 : Finding Median using Mathematical formula
Median = median(Sorted_PM);
fprintf('Median is %f' , Median)

% Step4: Finding Absolute Deviation about Mean
Abs_Mean = abs(Sorted_PM - Median);

% Step6 : Finding sum of Absolute Deviation about Median
Sum_Abs_Mean = sum(Abs_Mean);

% Tabular View
Student_Marks = table(Pocket_Money', Abs_Mean');
Student_Marks.Properties.VariableNames = { 'Pocket Money' , 'Absolute Mean' }

% Method : Via using traditional mathematical formula finding Mean Deviation about Median
% Mean Deviation = (sum(|X - median(X)|))./length(X)
Mean_Deviation = (Sum_Abs_Mean)./(length(Sorted_PM));
fprintf('Value of Mean Deviation (using mathematical formula approach) is %f' , Mean_Deviation)
% --------------------------------------------------------------------------------
```

```
Pocket_Money = 1×5
    20    50   100    90    75
```

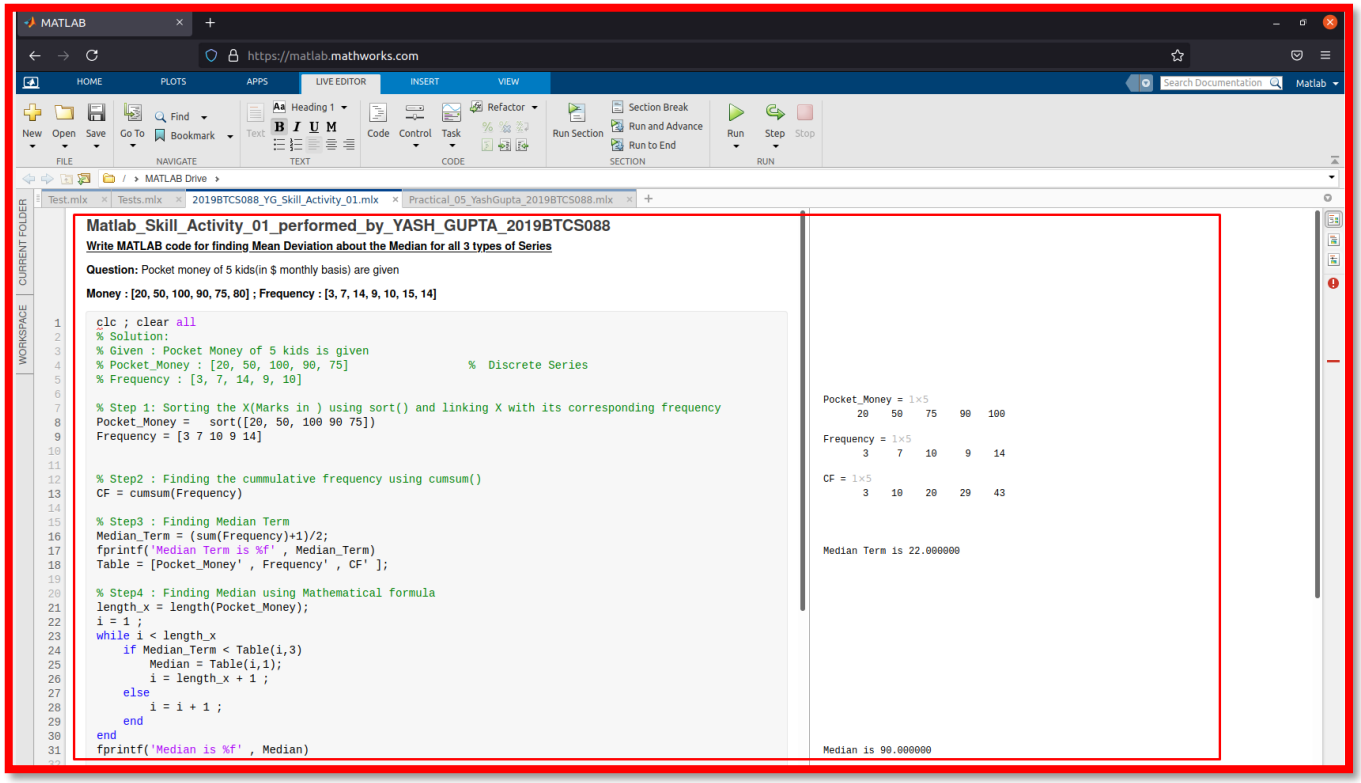
```
Median is 75.000000
```

Student_Marks = 5×2 table

	Pocket Money	Absolute Mean
1	20	55
2	50	25
3	100	0
4	90	15
5	75	25

```
Value of Mean Deviation (using mathematical formula approach) is 24.000000
```

Example 2: Mean Deviation about Median for Discrete Series



Matlab_Skill_Activity_01_performed_by_YASH_GUPTA_2019BTCS088

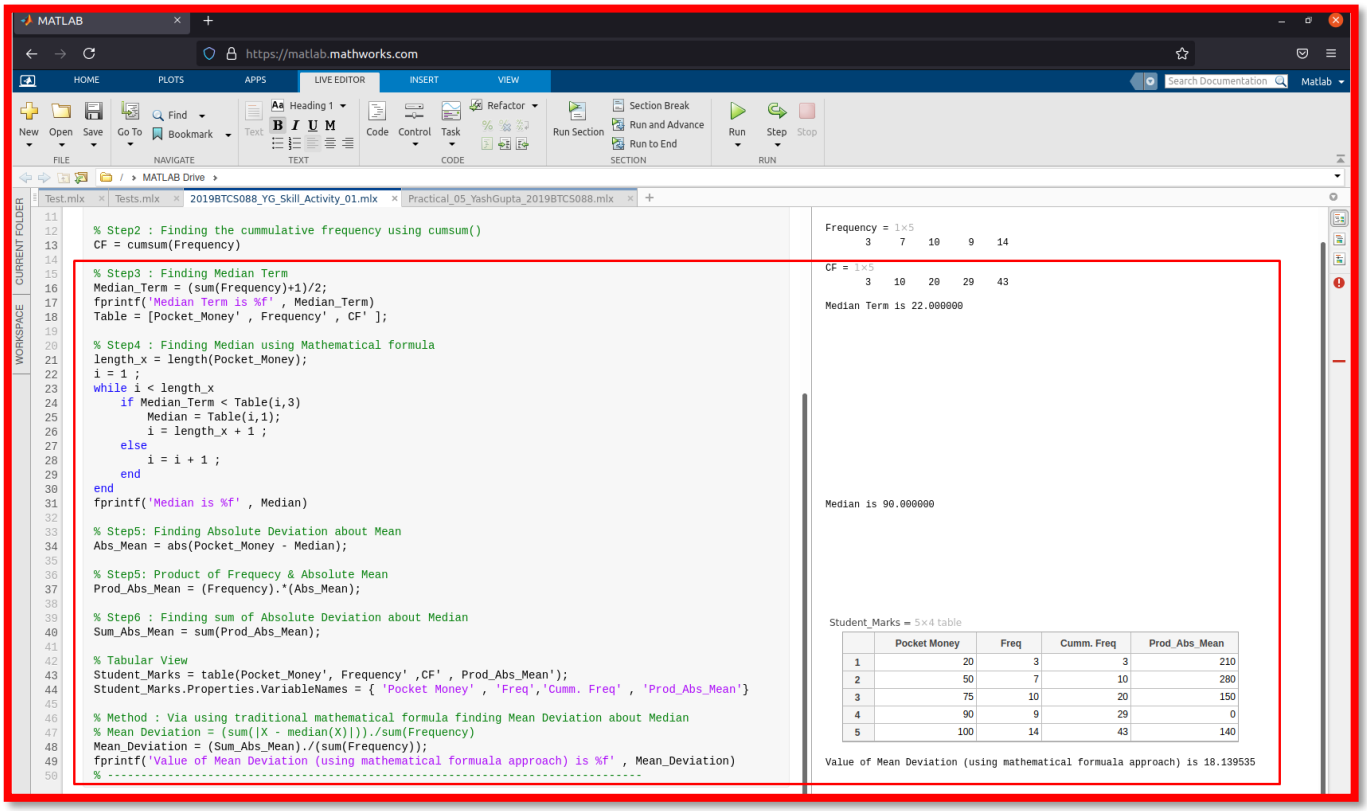
Write MATLAB code for finding Mean Deviation about the Median for all 3 types of Series

Question: Pocket money of 5 kids(in $ monthly basis) are given

Money : [20, 50, 100, 90, 75, 80] ; Frequency : [3, 7, 14, 9, 10, 15, 14]

```
clc ; clear all
% Solution:
% Given : Pocket Money of 5 kids is given
% Pocket_Money : [20, 50, 100, 90, 75]                 %  Discrete Series
% Frequency : [3, 7, 14, 9, 10]

% Step 1: Sorting the X(Marks in ) using sort() and linking X with its corresponding frequency
Pocket_Money =   sort([20, 50, 100 90 75])
Frequency = [3 7 10 9 14]


% Step2 : Finding the cummulative frequency using cumsum()
CF = cumsum(Frequency)

% Step3 : Finding Median Term
Median_Term = (sum(Frequency)+1)/2;
fprintf('Median Term is %f' , Median_Term)
Table = [Pocket_Money' , Frequency' , CF' ];

% Step4 : Finding Median using Mathematical formula
length_x = length(Pocket_Money);
i = 1 ;
while i < length_x
    if Median_Term < Table(i,3)
        Median = Table(i,1);
        i = length_x + 1 ;
    else
        i = i + 1 ;
    end
end
fprintf('Median is %f' , Median)
```

```
Pocket_Money = 1×5
    20    50    75    90   100

Frequency = 1×5
     3     7    10     9    14

CF = 1×5
     3    10    20    29    43

Median Term is 22.000000

Median is 90.000000
```



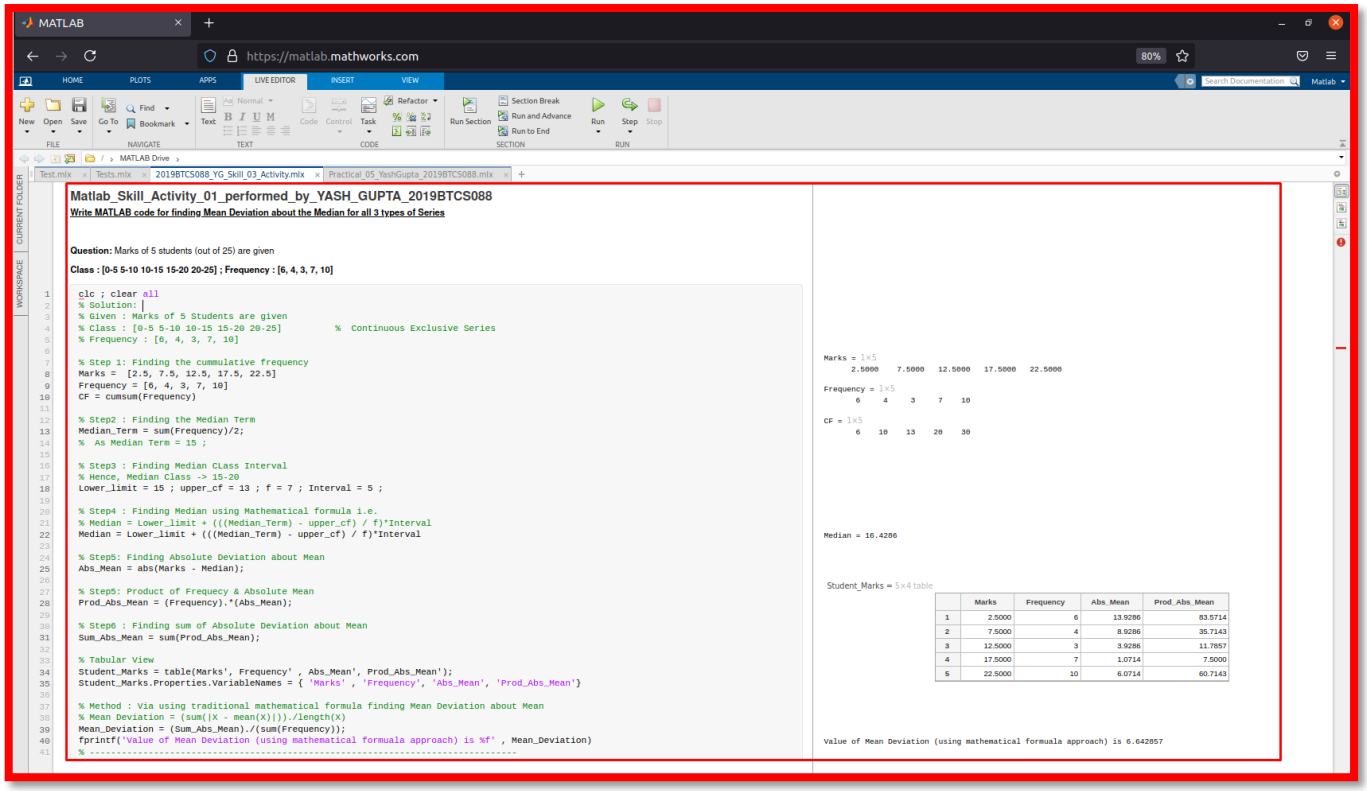
```
% Step2 : Finding the cummulative frequency using cumsum()
CF = cumsum(Frequency)

% Step3 : Finding Median Term
Median_Term = (sum(Frequency)+1)/2;
fprintf('Median Term is %f' , Median_Term)
Table = [Pocket_Money' , Frequency' , CF' ];

% Step4 : Finding Median using Mathematical formula
length_x = length(Pocket_Money);
i = 1 ;
while i < length_x
    if Median_Term < Table(i,3)
        Median = Table(i,1);
        i = length_x + 1 ;
    else
        i = i + 1 ;
    end
end
fprintf('Median is %f' , Median)

% Step5: Finding Absolute Deviation about Mean
Abs_Mean = abs(Pocket_Money - Median);

% Step5: Product of Frequecy & Absolute Mean
Prod_Abs_Mean = (Frequency).*(Abs_Mean);

% Step6 : Finding sum of Absolute Deviation about Median
Sum_Abs_Mean = sum(Prod_Abs_Mean);

% Tabular View
Student_Marks = table(Pocket_Money', Frequency' ,CF' , Prod_Abs_Mean');
Student_Marks.Properties.VariableNames = { 'Pocket Money' , 'Freq','Cumm. Freq' , 'Prod_Abs_Mean'}

% Method : Via using traditional mathematical formula finding Mean Deviation about Median
% Mean Deviation = (sum(|X - median(X)|))./sum(Frequency)
Mean_Deviation = (Sum_Abs_Mean)./(sum(Frequency));
fprintf('Value of Mean Deviation (using mathematical formuala approach) is %f' , Mean_Deviation)
% ------------------------------------------------------------------------
```

```
Frequency = 1×5
     3     7    10     9    14

CF = 1×5
     3    10    20    29    43

Median Term is 22.000000

Median is 90.000000

Student_Marks = 5×4 table
```

	Pocket Money	Freq	Cumm. Freq	Prod_Abs_Mean
1	20	3	3	210
2	50	7	10	280
3	75	10	20	150
4	90	9	29	0
5	100	14	43	140

```
Value of Mean Deviation (using mathematical formuala approach) is 18.139535
```

E. Example 3: Mean Deviation about Median for Continuous Series



Matlab_Skill_Activity_01_performed_by_YASH_GUPTA_2019BTCS088

Write MATLAB code for finding Mean Deviation about the Median for all 3 types of Series

Question: Marks of 5 students (out of 25) are given

Class : [0-5 5-10 10-15 15-20 20-25] ; Frequency : [6, 4, 3, 7, 10]

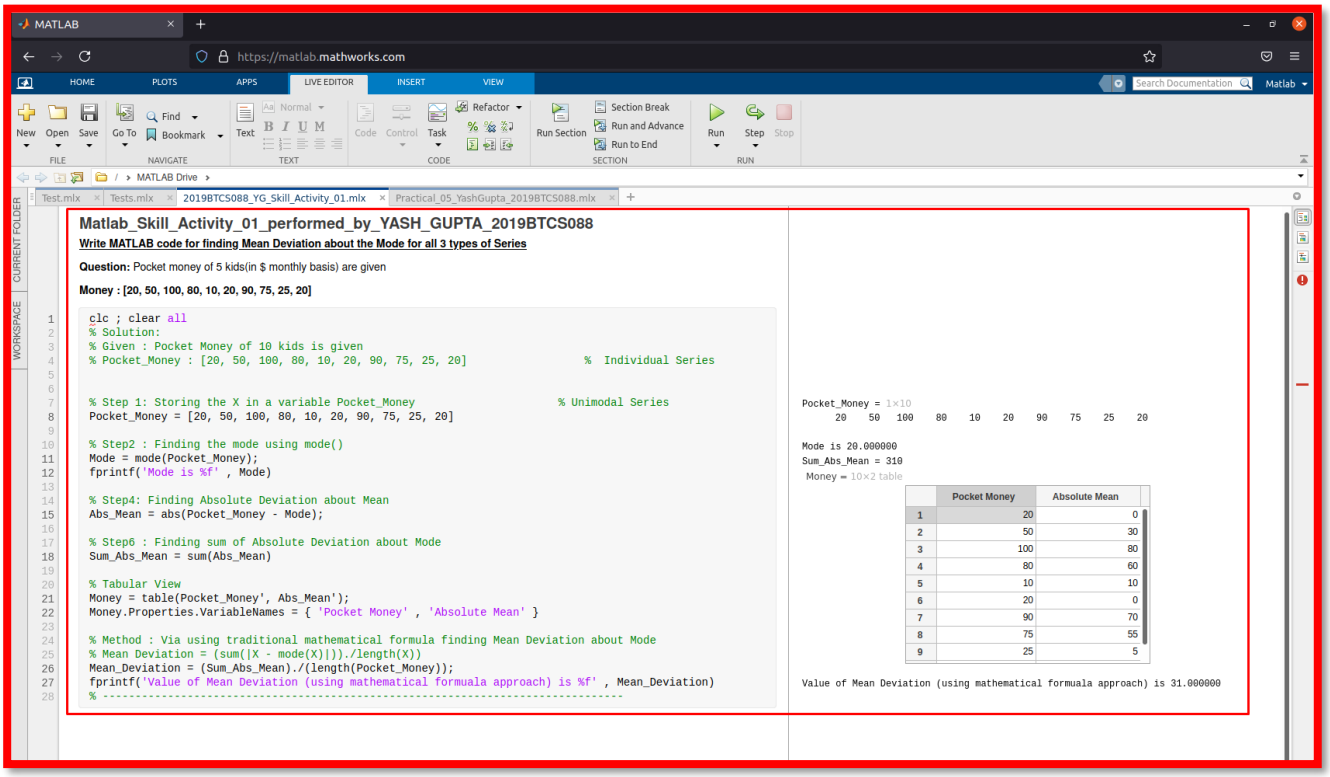
```
clc ; clear all
% Solution:
% Given : Marks of 5 Students are given
% Class : [0-5 5-10 10-15 15-20 20-25]          %  Continuous Exclusive Series
% Frequency : [6, 4, 3, 7, 10]

% Step 1: Finding the cummulative frequency
Marks =  [2.5, 7.5, 12.5, 17.5, 22.5]
Frequency = [6, 4, 3, 7, 10]
CF = cumsum(Frequency)

% Step2 : Finding the Median Term
Median_Term = sum(Frequency)/2;
%  As Median Term = 15 ;

% Step3 : Finding Median CLass Interval
% Hence, Median Class -> 15-20
Lower_limit = 15 ; upper_cf = 13 ; f = 7 ; Interval = 5 ;

% Step4 : Finding Median using Mathematical formula i.e.
% Median = Lower_limit + (((Median_Term) - upper_cf) / f)*Interval
Median = Lower_limit + (((Median_Term) - upper_cf) / f)*Interval

% Step5: Finding Absolute Deviation about Mean
Abs_Mean = abs(Marks - Median);

% Step5: Product of Frequecy & Absolute Mean
Prod_Abs_Mean = (Frequency).*(Abs_Mean);

% Step6 : Finding sum of Absolute Deviation about Mean
Sum_Abs_Mean = sum(Prod_Abs_Mean);

% Tabular View
Student_Marks = table(Marks', Frequency' , Abs_Mean', Prod_Abs_Mean');
Student_Marks.Properties.VariableNames = { 'Marks' , 'Frequency', 'Abs_Mean', 'Prod_Abs_Mean'}

% Method : Via using traditional mathematical formula finding Mean Deviation about Mean
% Mean Deviation = (sum(|X - mean(X)|))./length(X)
Mean_Deviation = (Sum_Abs_Mean)./(sum(Frequency));
fprintf('Value of Mean Deviation (using mathematical formuala approach) is %f' , Mean_Deviation)
% ------------------------------------------------------------------------------
```

```
Marks = 1×5
    2.5000    7.5000   12.5000   17.5000   22.5000

Frequency = 1×5
     6     4     3     7    10

CF = 1×5
     6    10    13    20    30

Median = 16.4286

Student_Marks = 5×4 table
```

	Marks	Frequency	Abs_Mean	Prod_Abs_Mean
1	2.5000	6	13.9286	83.5714
2	7.5000	4	8.9286	35.7143
3	12.5000	3	3.9286	11.7857
4	17.5000	7	1.0714	7.5000
5	22.5000	10	6.0714	60.7143

```
Value of Mean Deviation (using mathematical formuala approach) is 6.642857
```

F. Example 1: Mean Deviation from Mode for Individual Series



Matlab_Skill_Activity_01_performed_by_YASH_GUPTA_2019BTCS088

Write MATLAB code for finding Mean Deviation about the Mode for all 3 types of Series

Question: Pocket money of 5 kids(in $ monthly basis) are given

Money : [20, 50, 100, 80, 10, 20, 90, 75, 25, 20]

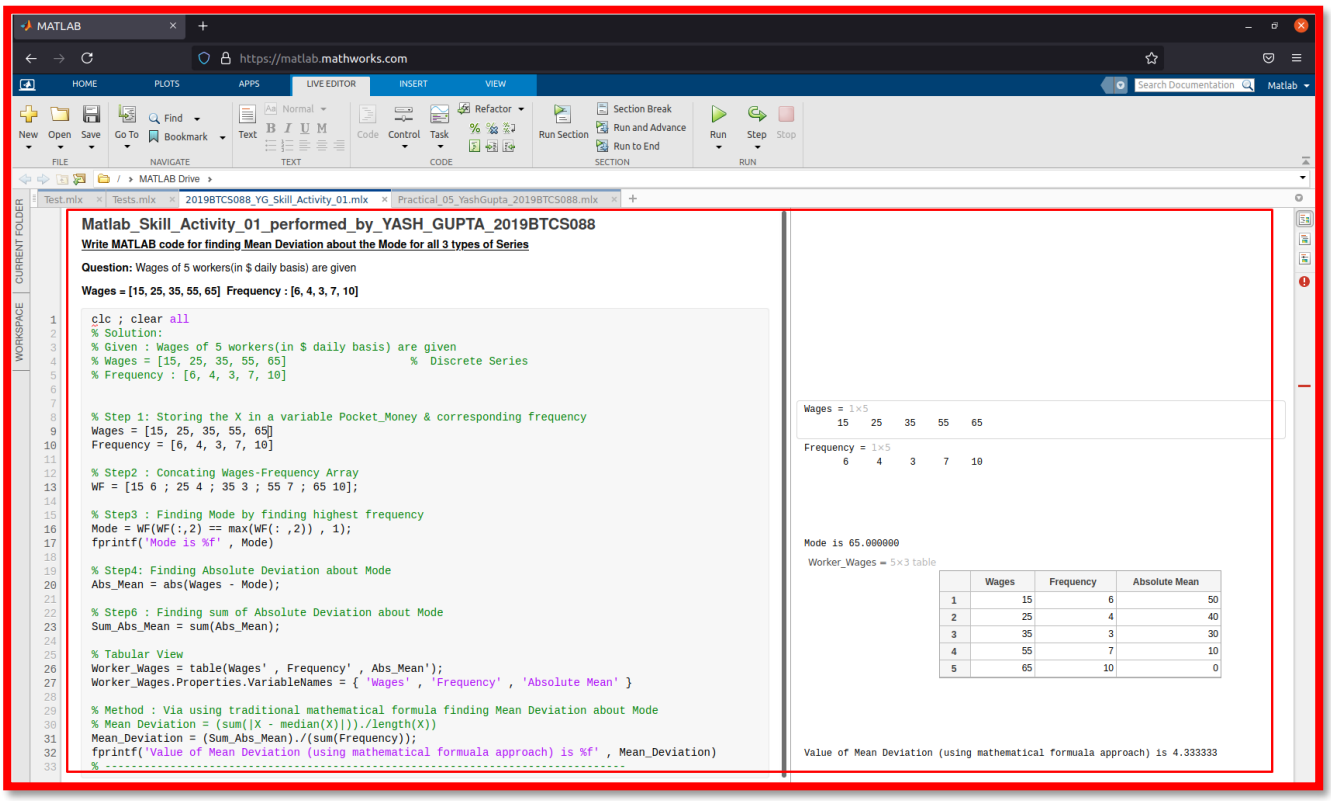
```
clc ; clear all
% Solution:
% Given : Pocket Money of 10 kids is given
% Pocket_Money : [20, 50, 100, 80, 10, 20, 90, 75, 25, 20]                %  Individual Series


% Step 1: Storing the X in a variable Pocket_Money                       % Unimodal Series
Pocket_Money = [20, 50, 100, 80, 10, 20, 90, 75, 25, 20]

% Step2 : Finding the mode using mode()
Mode = mode(Pocket_Money);
fprintf('Mode is %f' , Mode)

% Step4: Finding Absolute Deviation about Mean
Abs_Mean = abs(Pocket_Money - Mode);

% Step6 : Finding sum of Absolute Deviation about Mode
Sum_Abs_Mean = sum(Abs_Mean)

% Tabular View
Money = table(Pocket_Money', Abs_Mean');
Money.Properties.VariableNames = { 'Pocket Money' , 'Absolute Mean' }

% Method : Via using traditional mathematical formula finding Mean Deviation about Mode
% Mean Deviation = (sum(|X - mode(X)|))./length(X))
Mean_Deviation = (Sum_Abs_Mean)./(length(Pocket_Money));
fprintf('Value of Mean Deviation (using mathematical formuala approach) is %f' , Mean_Deviation)
% ------------------------------------------------------------------------------
```

```
Pocket_Money = 1×10
    20    50   100    80    10    20    90    75    25    20

Mode is 20.000000
Sum_Abs_Mean = 310
 Money = 10×2 table
```

	Pocket Money	Absolute Mean
1	20	0
2	50	30
3	100	80
4	80	60
5	10	10
6	20	0
7	90	70
8	75	55
9	25	5

```
Value of Mean Deviation (using mathematical formuala approach) is 31.000000
```

G. Example 2: Mean Deviation from Mode for Discrete Series



Matlab_Skill_Activity_01_performed_by_YASH_GUPTA_2019BTCS088

Write MATLAB code for finding Mean Deviation about the Mode for all 3 types of Series

Question: Wages of 5 workers(in $ daily basis) are given

Wages = [15, 25, 35, 55, 65] Frequency : [6, 4, 3, 7, 10]

```
clc ; clear all
% Solution:
% Given : Wages of 5 workers(in $ daily basis) are given
% Wages = [15, 25, 35, 55, 65]                  %  Discrete Series
% Frequency : [6, 4, 3, 7, 10]


% Step 1: Storing the X in a variable Pocket_Money & corresponding frequency
Wages = [15, 25, 35, 55, 65]
Frequency = [6, 4, 3, 7, 10]

% Step2 : Concating Wages-Frequency Array
WF = [15 6 ; 25 4 ; 35 3 ; 55 7 ; 65 10];

% Step3 : Finding Mode by finding highest frequency
Mode = WF(WF(:,2) == max(WF(: ,2)) , 1);
fprintf('Mode is %f' , Mode)

% Step4: Finding Absolute Deviation about Mode
Abs_Mean = abs(Wages - Mode);

% Step6 : Finding sum of Absolute Deviation about Mode
Sum_Abs_Mean = sum(Abs_Mean);

% Tabular View
Worker_Wages = table(Wages' , Frequency' , Abs_Mean');
Worker_Wages.Properties.VariableNames = { 'Wages' , 'Frequency' , 'Absolute Mean' }

% Method : Via using traditional mathematical formula finding Mean Deviation about Mode
% Mean Deviation = (sum(|X - median(X)|))./length(X))
Mean_Deviation = (Sum_Abs_Mean)./(sum(Frequency));
fprintf('Value of Mean Deviation (using mathematical formuala approach) is %f' , Mean_Deviation)
% ------------------------------------------------------------------------
```

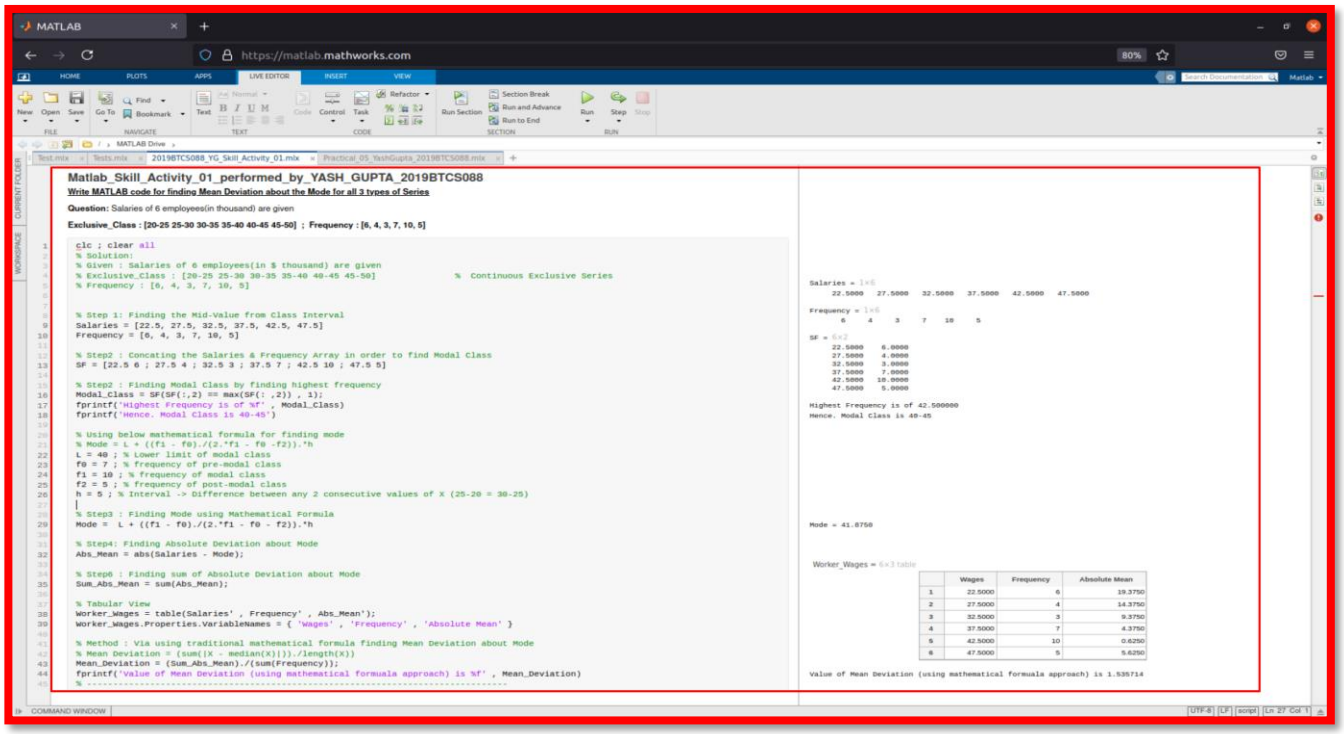
```
Wages = 1×5
    15    25    35    55    65

Frequency = 1×5
     6     4     3     7    10

Mode is 65.000000
```

Worker_Wages = 5×3 table

	Wages	Frequency	Absolute Mean
1	15	6	50
2	25	4	40
3	35	3	30
4	55	7	10
5	65	10	0

```
Value of Mean Deviation (using mathematical formuala approach) is 4.333333
```

H. Example 3: Mean Deviation from Mode for Continuous Series



Matlab_Skill_Activity_01_performed_by_YASH_GUPTA_2019BTCS088

Write MATLAB code for finding Mean Deviation about the Mode for all 3 types of Series

Question: Salaries of 6 employees(in thousand) are given

Exclusive_Class : [20-25 25-30 30-35 35-40 40-45 45-50] ; Frequency : [6, 4, 3, 7, 10, 5]

```
clc ; clear all
% Solution:
% Given : Salaries of 6 employees(in $ thousand) are given
% Exclusive_Class : [20-25 25-30 30-35 35-40 40-45 45-50]              %  Continuous Exclusive Series
% Frequency : [6, 4, 3, 7, 10, 5]


% Step 1: Finding the Mid-Value from Class Interval
Salaries = [22.5, 27.5, 32.5, 37.5, 42.5, 47.5]
Frequency = [6, 4, 3, 7, 10, 5]

% Step2 : Concating the Salaries & Frequency Array in order to find Modal Class
SF = [22.5 6 ; 27.5 4 ; 32.5 3 ; 37.5 7 ; 42.5 10 ; 47.5 5]

% Step2 : Finding Modal Class by finding highest frequency
Modal_Class = SF(SF(:,2) == max(SF(: ,2)) , 1);
fprintf('Highest Frequency is of %f' , Modal_Class)
fprintf('Hence. Modal Class is 40-45')

% Using below mathematical formula for finding mode
% Mode = L + ((f1 - f0)./(2.*f1 - f0 -f2)).*h
L = 40 ; % Lower limit of modal class
f0 = 7 ; % frequency of pre-modal class
f1 = 10 ; % frequency of modal class
f2 = 5 ; % frequency of post-modal class
h = 5 ; % Interval -> difference between any 2 consecutive values of X (25-20 = 30-25)

% Step3 : Finding Mode using Mathematical Formula
Mode =  L + ((f1 - f0)./(2.*f1 - f0 - f2)).*h

% Step4: Finding Absolute Deviation about Mode
Abs_Mean = abs(Salaries - Mode);

% Step6 : Finding sum of Absolute Deviation about Mode
Sum_Abs_Mean = sum(Abs_Mean);

% Tabular View
Worker_Wages = table(Salaries' , Frequency' , Abs_Mean');
Worker_Wages.Properties.VariableNames = { 'Wages' , 'Frequency' , 'Absolute Mean' }

% Method : Via using traditional mathematical formula finding Mean Deviation about Mode
% Mean Deviation = (sum(|X - median(X)|))./length(X))
Mean_Deviation = (Sum_Abs_Mean)./(sum(Frequency));
fprintf('Value of Mean Deviation (using mathematical formuala approach) is %f' , Mean_Deviation)
% ------------------------------------------------------------------------
```

```
Salaries = 1×6
    22.5000   27.5000   32.5000   37.5000   42.5000   47.5000

Frequency = 1×6
     6     4     3     7    10     5

SF = 6×2
   22.5000    6.0000
   27.5000    4.0000
   32.5000    3.0000
   37.5000    7.0000
   42.5000   10.0000
   47.5000    5.0000

Highest Frequency is of 42.500000
Hence. Modal Class is 40-45

Mode = 41.8750
```

Worker_Wages = 6×3 table

	Wages	Frequency	Absolute Mean
1	22.5000	6	19.3750
2	27.5000	4	14.3750
3	32.5000	3	9.3750
4	37.5000	7	4.3750
5	42.5000	10	0.6250
6	47.5000	5	5.6250

```
Value of Mean Deviation (using mathematical formuala approach) is 1.535714
```

SKILL ACTIVITIY NO: 2

(Standard Deviation for all 3 types of Series)

Date: 17th June 2021

SKILL_ACTIVITY_02

Date: 17-June 2021

Title: Standard Deviation for all 3 types of series

1. What is the purpose of this activity? (Explain in 3-4 lines)

Ans: Purpose of this activity is to find out :-

(a) What is Standard Deviation?

(b) Why we need Standard Deviation as we have central tendency values i.e (Mean, Mode & Median)

(c) How Standard deviation is calculated for 3 different types of series
- → Individual Series
- → Discrete — " —
- → Continuous — " —

2. Steps performed in this Activity. (Explain in 5-6 lines)

Ans: (A) For finding Standard Deviation of Individual series

Step → (1) Take the mean of the "x" via using mean() in MATLAB

(2) Subtract the Mean from "x" & store in variable.

(3) Use above variable to square it.

(4) Then simply use the formula. $\sigma = \sqrt{\frac{\Sigma(x-\bar{x})^2}{N}}$

// By Traditional approach (Actual Mean Method) → Σ → $SD(\sigma) = \sqrt{\frac{\Sigma(x-\bar{x})^2}{N}}$

(5) equals

// Method 2 → Step (1) Directly use the std() function of MATLAB to find standard Deviation. In argument of std() provide your "x" {series}

(B) For finding Standard Deviation of Discrete Series

Step (1) Here, we have Discrete values i.e → (x & freq)

// (2) find out if the difference b/w "x" values are equal or Not

If NOT EQUAL → Then we gonna use Assumed Mean Deviation Method for finding Standard Deviation. (S.D(σ))

Step (3) Find out Σfreq → & store in var N.

Step (4) Then, Assume mean from yourself → & store in a var.

Step ⑤: Subtract the Assumed mean from 'X' & store in var. 'D'

Step ⑥: Then square the ~~variable~~ above (D) var & store in New var.

Step ⑦: Find out the value of ($\Sigma f.d$) & ($\Sigma f.d^2$) using the 'D' var

Step ⑧: After all, apply the formula of Assumed Mean for finding Standard Deviation.

$$\sigma = \sqrt{\frac{\Sigma f.D^2}{N} - \frac{\Sigma f.D}{N}}$$

ⓒ For finding Standard Deviation of Continious Exclusive Series:

Step ①: Here, we have given Classes & their respective Frequencies. So first we take out the (MIDDLE-) values of the classe & store in the var 'X' (Marks/ salary)

Step ②: Calculate the value of N → (Σf), h (Interval diff. btw X)

Step ③: Here, we have to use {Step Deviation Method}

$$\sigma = \left(\sqrt{\frac{\Sigma fD^2}{N} - \frac{\Sigma f.D}{N}}\right) * h$$

Step ④: Find the Mean → {via Assumed Mean}

Step ⑤: find the value of $D = \frac{(X - Mean)}{h}$

Step ⑥: Square the value of D & store in particular var.

Step ⑦: After all above steps, apply the Step Deviation Method for finding Standard Deviation.

$$\sigma = \left(\sqrt{\frac{\Sigma f.D^2}{N} - \frac{\Sigma f.D}{N}}\right) * h$$

3. What Resources/ Materials/Equipment's/tools did you use for this activity?

Ans: ① MATLAB 30-day total software

② Standard Deviation Cheatsheet

4. What skills did you acquire?

→ Get to know about what is Standard Deviation?

→ Why we Need Standard Deviation?

→ How to use MATLAB coding for Standard Deviation?

→ Use of std() function, Matrix multiplication, Matrix Division)

→ Use of Table() in MATAB.

5. Time taken to complete this activity? 03:00 (hours)

Yagupta

Signature of Students

(To be filled by Faculty)

Sr. No.	Skill /Competencies	(Achieved / Not Achieved) (Yes / No)

Remarks :

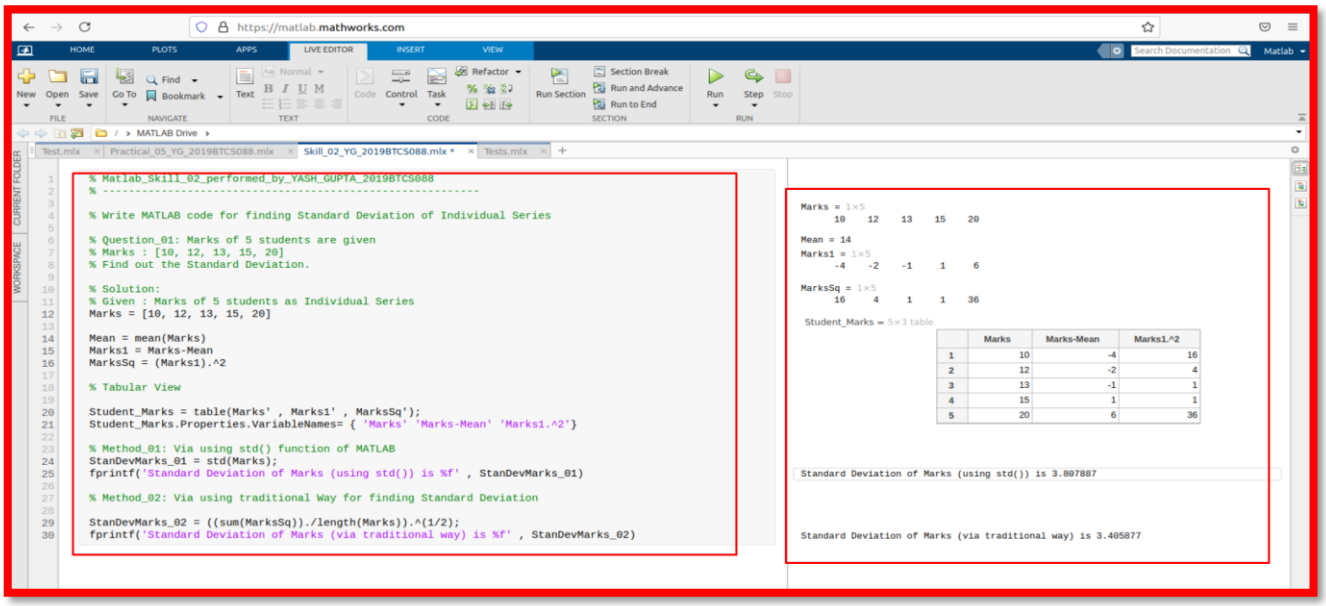
Total mark _____out of 10.

Signature of Faculty

Date: _____

Details of the Activity

A. Example 1: Standard Deviation for Individual Series.



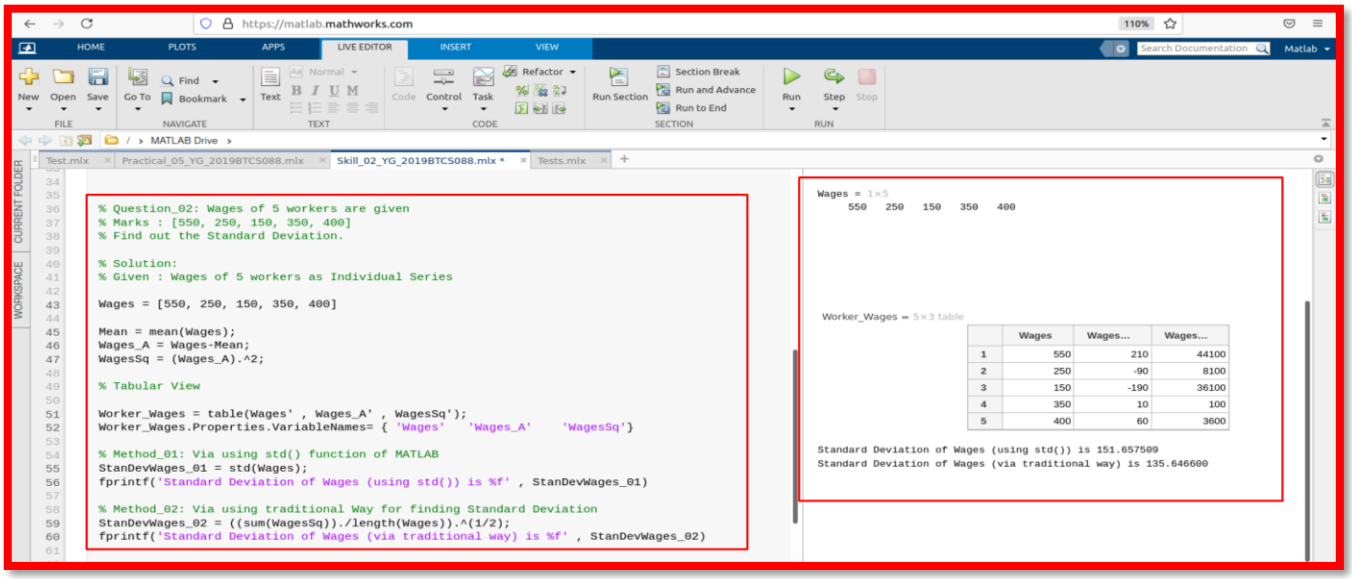
```
% Matlab_Skill_02_performed_by_YASH_GUPTA_2019BTCS088
% ------------------------------------------------------------

% Write MATLAB code for finding Standard Deviation of Individual Series

% Question_01: Marks of 5 students are given
% Marks : [10, 12, 13, 15, 20]
% Find out the Standard Deviation.

% Solution:
% Given : Marks of 5 students as Individual Series
Marks = [10, 12, 13, 15, 20]

Mean = mean(Marks)
Marks1 = Marks-Mean
MarksSq = (Marks1).^2

% Tabular View

Student_Marks = table(Marks' , Marks1' , MarksSq');
Student_Marks.Properties.VariableNames= { 'Marks' 'Marks-Mean' 'Marks1.^2'}

% Method_01: Via using std() function of MATLAB
StanDevMarks_01 = std(Marks);
fprintf('Standard Deviation of Marks (using std()) is %f' , StanDevMarks_01)

% Method_02: Via using traditional Way for finding Standard Deviation

StanDevMarks_02 = ((sum(MarksSq))./length(Marks)).^(1/2);
fprintf('Standard Deviation of Marks (via traditional way) is %f' , StanDevMarks_02)
```

```
Marks = 1×5
    10    12    13    15    20

Mean = 14
Marks1 = 1×5
    -4    -2    -1     1     6

MarksSq = 1×5
    16     4     1     1    36

Student_Marks = 5×3 table
```

	Marks	Marks-Mean	Marks1.^2
1	10	-4	16
2	12	-2	4
3	13	-1	1
4	15	1	1
5	20	6	36

```
Standard Deviation of Marks (using std()) is 3.807887

Standard Deviation of Marks (via traditional way) is 3.405877
```

B. Example 2: Standard Deviation for Individual Series.



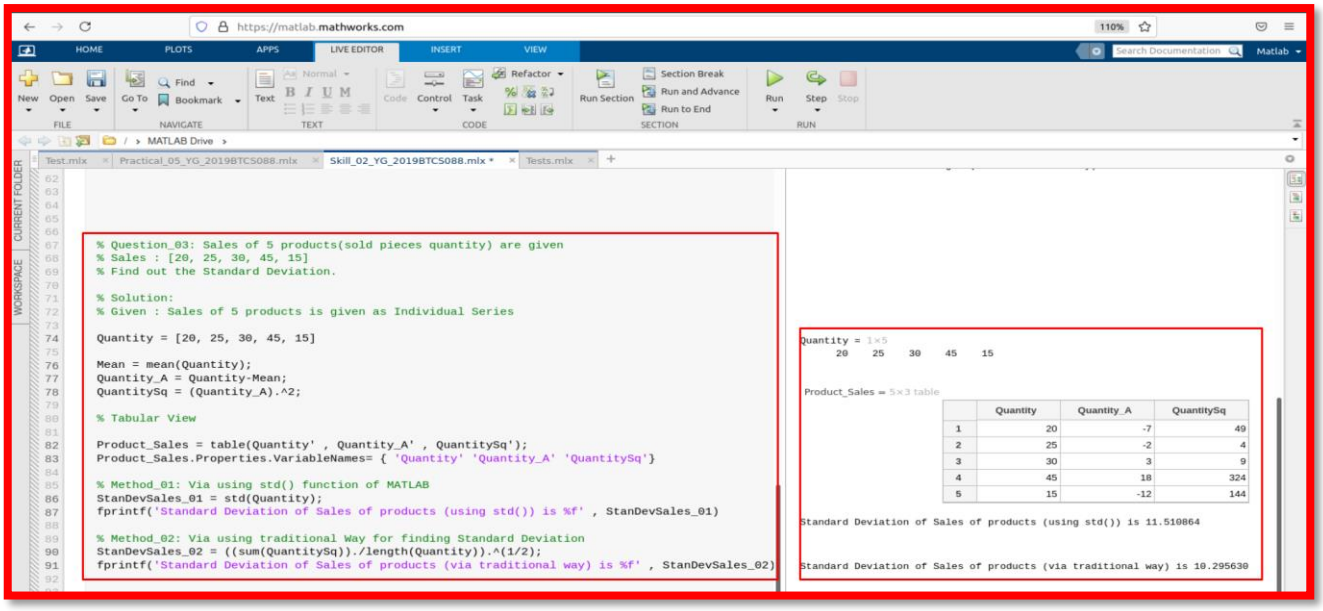
```
% Question_02: Wages of 5 workers are given
% Marks : [550, 250, 150, 350, 400]
% Find out the Standard Deviation.

% Solution:
% Given : Wages of 5 workers as Individual Series

Wages = [550, 250, 150, 350, 400]

Mean = mean(Wages);
Wages_A = Wages-Mean;
WagesSq = (Wages_A).^2;

% Tabular View

Worker_Wages = table(Wages' , Wages_A' , WagesSq');
Worker_Wages.Properties.VariableNames= { 'Wages'   'Wages_A'    'WagesSq'}

% Method_01: Via using std() function of MATLAB
StanDevWages_01 = std(Wages);
fprintf('Standard Deviation of Wages (using std()) is %f' , StanDevWages_01)

% Method_02: Via using traditional Way for finding Standard Deviation
StanDevWages_02 = ((sum(WagesSq))./length(Wages)).^(1/2);
fprintf('Standard Deviation of Wages (via traditional way) is %f' , StanDevWages_02)
```

```
Wages = 1×5
   550   250   150   350   400

Worker_Wages = 5×3 table
```

	Wages	Wages...	Wages...
1	550	210	44100
2	250	-90	8100
3	150	-190	36100
4	350	10	100
5	400	60	3600

```
Standard Deviation of Wages (using std()) is 151.657509
Standard Deviation of Wages (via traditional way) is 135.646600
```

C. Example 3: Standard Deviation for Individual Series.



```
% Question_03: Sales of 5 products(sold pieces quantity) are given
% Sales : [20, 25, 30, 45, 15]
% Find out the Standard Deviation.

% Solution:
% Given : Sales of 5 products is given as Individual Series

Quantity = [20, 25, 30, 45, 15]

Mean = mean(Quantity);
Quantity_A = Quantity-Mean;
QuantitySq = (Quantity_A).^2;

% Tabular View

Product_Sales = table(Quantity' , Quantity_A' , QuantitySq');
Product_Sales.Properties.VariableNames= { 'Quantity' 'Quantity_A' 'QuantitySq'}

% Method_01: Via using std() function of MATLAB
StanDevSales_01 = std(Quantity);
fprintf('Standard Deviation of Sales of products (using std()) is %f' , StanDevSales_01)

% Method_02: Via using traditional Way for finding Standard Deviation
StanDevSales_02 = ((sum(QuantitySq))./length(Quantity)).^(1/2);
fprintf('Standard Deviation of Sales of products (via traditional way) is %f' , StanDevSales_02)
```

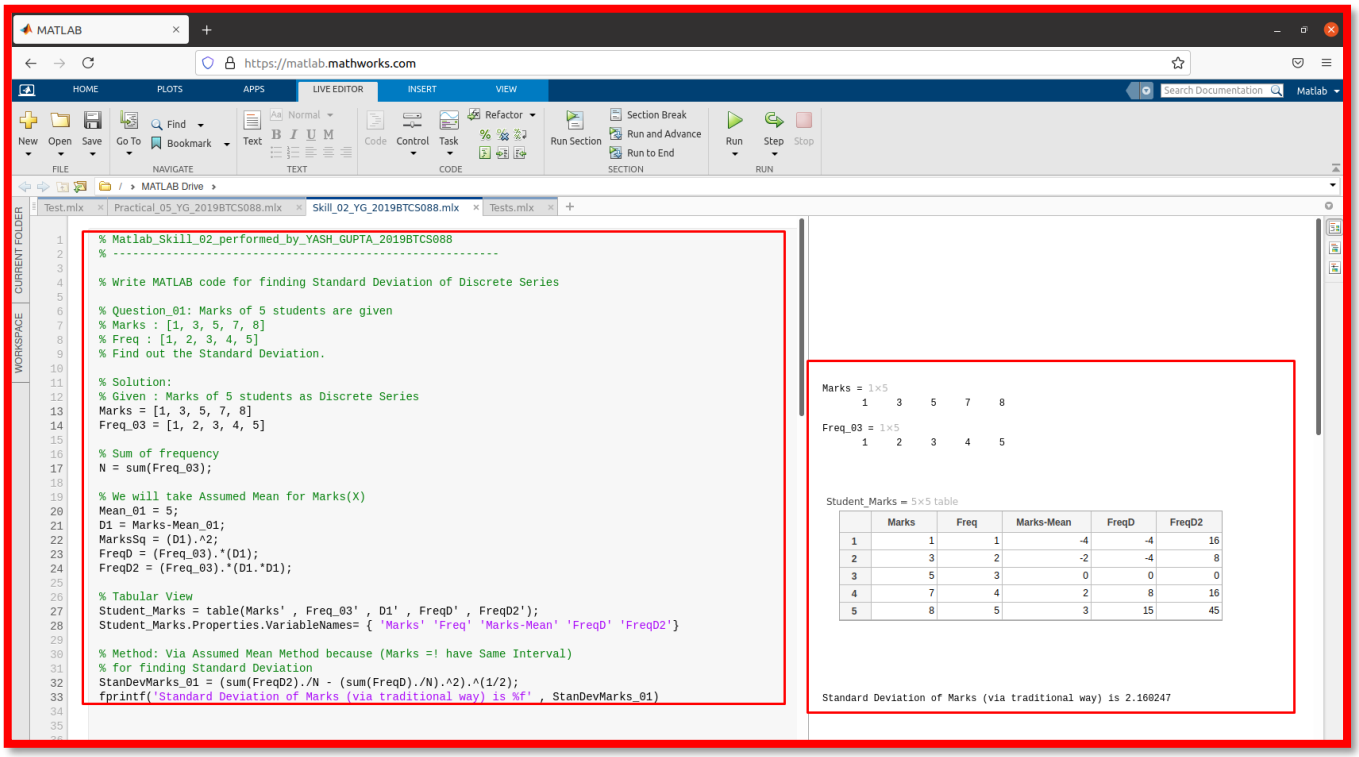
```
Quantity = 1×5
    20    25    30    45    15

Product_Sales = 5×3 table
```

	Quantity	Quantity_A	QuantitySq
1	20	-7	49
2	25	-2	4
3	30	3	9
4	45	18	324
5	15	-12	144

```
Standard Deviation of Sales of products (using std()) is 11.510864

Standard Deviation of Sales of products (via traditional way) is 10.295630
```

-

D. Example 1: Standard Deviation for Discrete Series.



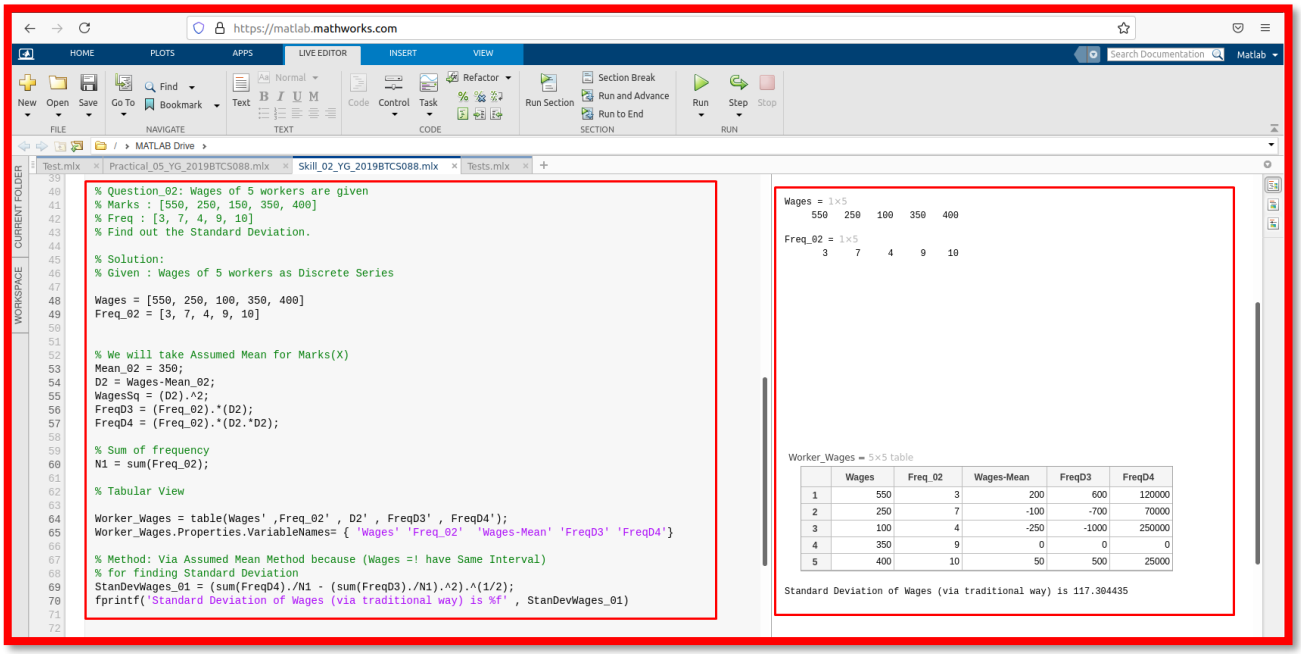
```
% Matlab_Skill_02_performed_by_YASH_GUPTA_2019BTCS088
% ------------------------------------------------------

% Write MATLAB code for finding Standard Deviation of Discrete Series

% Question_01: Marks of 5 students are given
% Marks : [1, 3, 5, 7, 8]
% Freq : [1, 2, 3, 4, 5]
% Find out the Standard Deviation.

% Solution:
% Given : Marks of 5 students as Discrete Series
Marks = [1, 3, 5, 7, 8]
Freq_03 = [1, 2, 3, 4, 5]

% Sum of frequency
N = sum(Freq_03);

% We will take Assumed Mean for Marks(X)
Mean_01 = 5;
D1 = Marks-Mean_01;
MarksSq = (D1).^2;
FreqD = (Freq_03).*(D1);
FreqD2 = (Freq_03).*(D1.*D1);

% Tabular View
Student_Marks = table(Marks' , Freq_03' , D1' , FreqD' , FreqD2');
Student_Marks.Properties.VariableNames= { 'Marks' 'Freq' 'Marks-Mean' 'FreqD' 'FreqD2'}

% Method: Via Assumed Mean Method because (Marks =! have Same Interval)
% for finding Standard Deviation
StanDevMarks_01 = (sum(FreqD2)./N - (sum(FreqD)./N).^2).^(1/2);
fprintf('Standard Deviation of Marks (via traditional way) is %f' , StanDevMarks_01)
```

```
Marks = 1×5
     1     3     5     7     8

Freq_03 = 1×5
     1     2     3     4     5

Student_Marks = 5×5 table
```

	Marks	Freq	Marks-Mean	FreqD	FreqD2
1	1	1	-4	-4	16
2	3	2	-2	-4	8
3	5	3	0	0	0
4	7	4	2	8	16
5	8	5	3	15	45

```
Standard Deviation of Marks (via traditional way) is 2.160247
```

E. Example 2: Standard Deviation for Discrete Series.



```
% Question_02: Wages of 5 workers are given
% Marks : [550, 250, 150, 350, 400]
% Freq : [3, 7, 4, 9, 10]
% Find out the Standard Deviation.

% Solution:
% Given : Wages of 5 workers as Discrete Series

Wages = [550, 250, 100, 350, 400]
Freq_02 = [3, 7, 4, 9, 10]


% We will take Assumed Mean for Marks(X)
Mean_02 = 350;
D2 = Wages-Mean_02;
WagesSq = (D2).^2;
FreqD3 = (Freq_02).*(D2);
FreqD4 = (Freq_02).*(D2.*D2);

% Sum of frequency
N1 = sum(Freq_02);

% Tabular View

Worker_Wages = table(Wages' ,Freq_02' , D2' , FreqD3' , FreqD4');
Worker_Wages.Properties.VariableNames= { 'Wages' 'Freq_02'  'Wages-Mean' 'FreqD3' 'FreqD4'}

% Method: Via Assumed Mean Method because (Wages =! have Same Interval)
% for finding Standard Deviation
StanDevWages_01 = (sum(FreqD4)./N1 - (sum(FreqD3)./N1).^2).^(1/2);
fprintf('Standard Deviation of Wages (via traditional way) is %f' , StanDevWages_01)
```

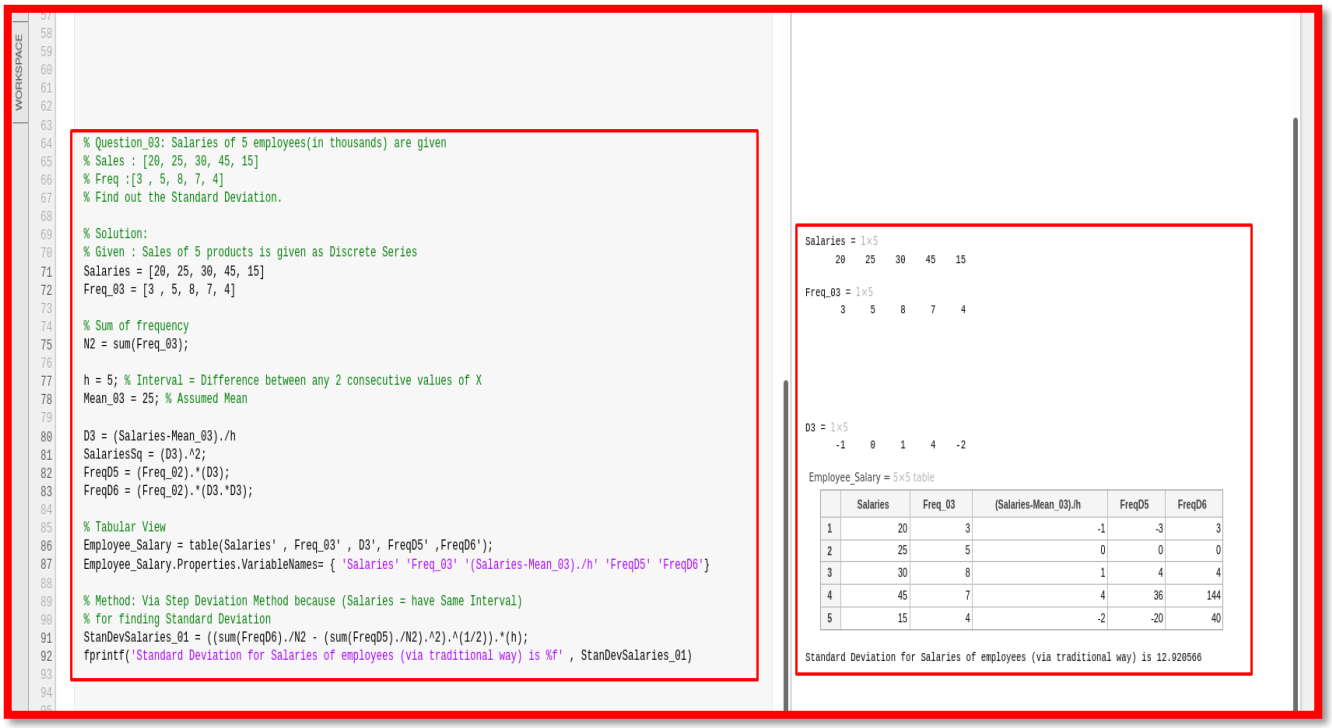
```
Wages = 1×5
     550   250   100   350   400

Freq_02 = 1×5
       3     7     4     9    10
```

Worker_Wages = 5×5 table

	Wages	Freq_02	Wages-Mean	FreqD3	FreqD4
1	550	3	200	600	120000
2	250	7	-100	-700	70000
3	100	4	-250	-1000	250000
4	350	9	0	0	0
5	400	10	50	500	25000

```
Standard Deviation of Wages (via traditional way) is 117.304435
```

F. Example 3: Standard Deviation for Discrete Series.



```
% Question_03: Salaries of 5 employees(in thousands) are given
% Sales : [20, 25, 30, 45, 15]
% Freq :[3 , 5, 8, 7, 4]
% Find out the Standard Deviation.

% Solution:
% Given : Sales of 5 products is given as Discrete Series
Salaries = [20, 25, 30, 45, 15]
Freq_03 = [3 , 5, 8, 7, 4]

% Sum of frequency
N2 = sum(Freq_03);

h = 5; % Interval = Difference between any 2 consecutive values of X
Mean_03 = 25; % Assumed Mean

D3 = (Salaries-Mean_03)./h
SalariesSq = (D3).^2;
FreqD5 = (Freq_02).*(D3);
FreqD6 = (Freq_02).*(D3.*D3);

% Tabular View
Employee_Salary = table(Salaries' , Freq_03' , D3', FreqD5' ,FreqD6');
Employee_Salary.Properties.VariableNames= { 'Salaries' 'Freq_03' '(Salaries-Mean_03)./h' 'FreqD5' 'FreqD6'}

% Method: Via Step Deviation Method because (Salaries = have Same Interval)
% for finding Standard Deviation
StanDevSalaries_01 = ((sum(FreqD6)./N2 - (sum(FreqD5)./N2).^2).^(1/2)).*(h);
fprintf('Standard Deviation for Salaries of employees (via traditional way) is %f' , StanDevSalaries_01)
```

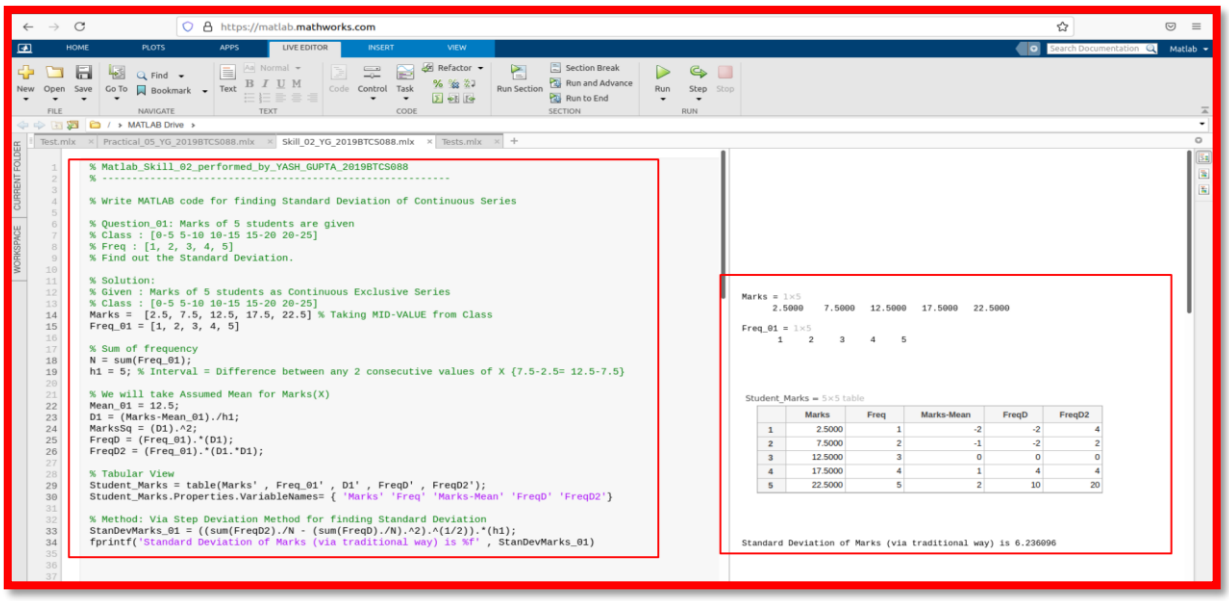
```
Salaries = 1×5
     20   25   30   45   15

Freq_03 = 1×5
       3     5     8     7     4

D3 = 1×5
      -1     0     1     4    -2
```

Employee_Salary = 5×5 table

	Salaries	Freq_03	(Salaries-Mean_03)./h	FreqD5	FreqD6
1	20	3	-1	-3	3
2	25	5	0	0	0
3	30	8	1	4	4
4	45	7	4	36	144
5	15	4	-2	-20	40

```
Standard Deviation for Salaries of employees (via traditional way) is 12.920566
```

G. Example 1: Standard Deviation for Continuous Series.



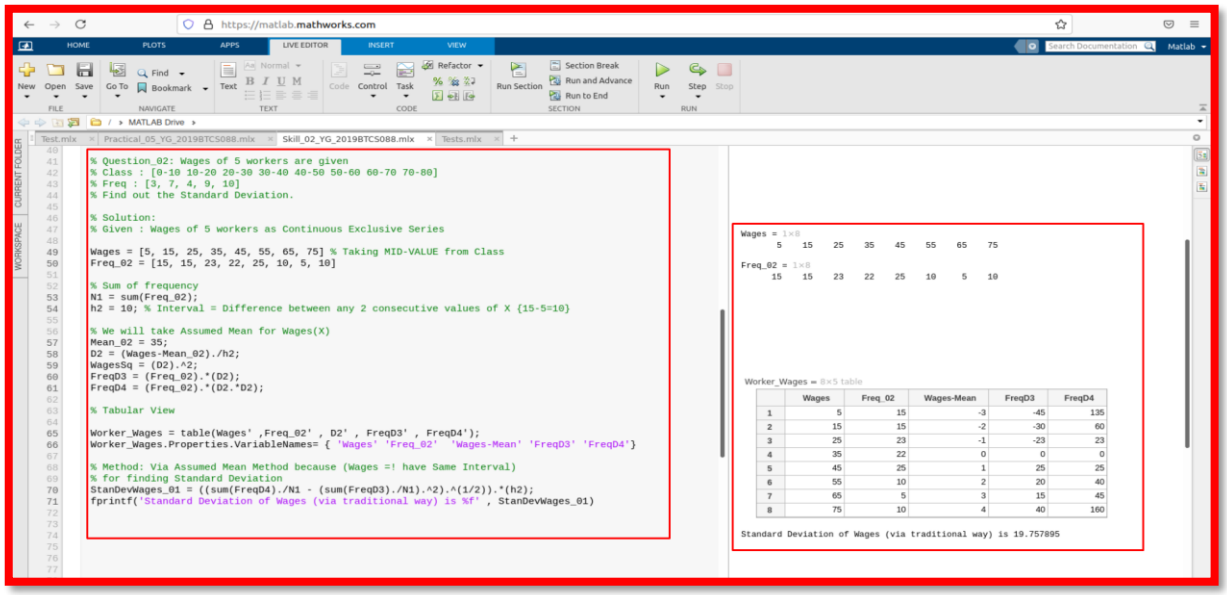
```
% Matlab_Skill_02_performed_by_YASH_GUPTA_2019BTCS088
% ------------------------------------------------------------

% Write MATLAB code for finding Standard Deviation of Continuous Series

% Question_01: Marks of 5 students are given
% Class : [0-5 5-10 10-15 15-20 20-25]
% Freq : [1, 2, 3, 4, 5]
% Find out the Standard Deviation.

% Solution:
% Given : Marks of 5 students as Continuous Exclusive Series
% Class : [0-5 5-10 10-15 15-20 20-25]
Marks = [2.5, 7.5, 12.5, 17.5, 22.5] % Taking MID-VALUE from Class
Freq_01 = [1, 2, 3, 4, 5]

% Sum of frequency
N = sum(Freq_01);
h1 = 5; % Interval = Difference between any 2 consecutive values of X {7.5-2.5= 12.5-7.5}

% We will take Assumed Mean for Marks(X)
Mean_01 = 12.5;
D1 = (Marks-Mean_01)./h1;
MarksSq = (D1).^2;
FreqD = (Freq_01).*(D1);
FreqD2 = (Freq_01).*(D1.*D1);

% Tabular View
Student_Marks = table(Marks' , Freq_01' , D1' , FreqD' , FreqD2');
Student_Marks.Properties.VariableNames= { 'Marks' 'Freq' 'Marks-Mean' 'FreqD' 'FreqD2'}

% Method: Via Step Deviation Method for finding Standard Deviation
StanDevMarks_01 = ((sum(FreqD2)./N - (sum(FreqD)./N).^2).^(1/2)).*(h1);
fprintf('Standard Deviation of Marks (via traditional way) is %f' , StanDevMarks_01)
```

```
Marks = 1×5
    2.5000    7.5000   12.5000   17.5000   22.5000

Freq_01 = 1×5
     1     2     3     4     5

Student_Marks = 5×5 table
```

	Marks	Freq	Marks-Mean	FreqD	FreqD2
1	2.5000	1	-2	-2	4
2	7.5000	2	-1	-2	2
3	12.5000	3	0	0	0
4	17.5000	4	1	4	4
5	22.5000	5	2	10	20

```
Standard Deviation of Marks (via traditional way) is 6.236096
```

H. Example 2: Standard Deviation for Continuous Series.



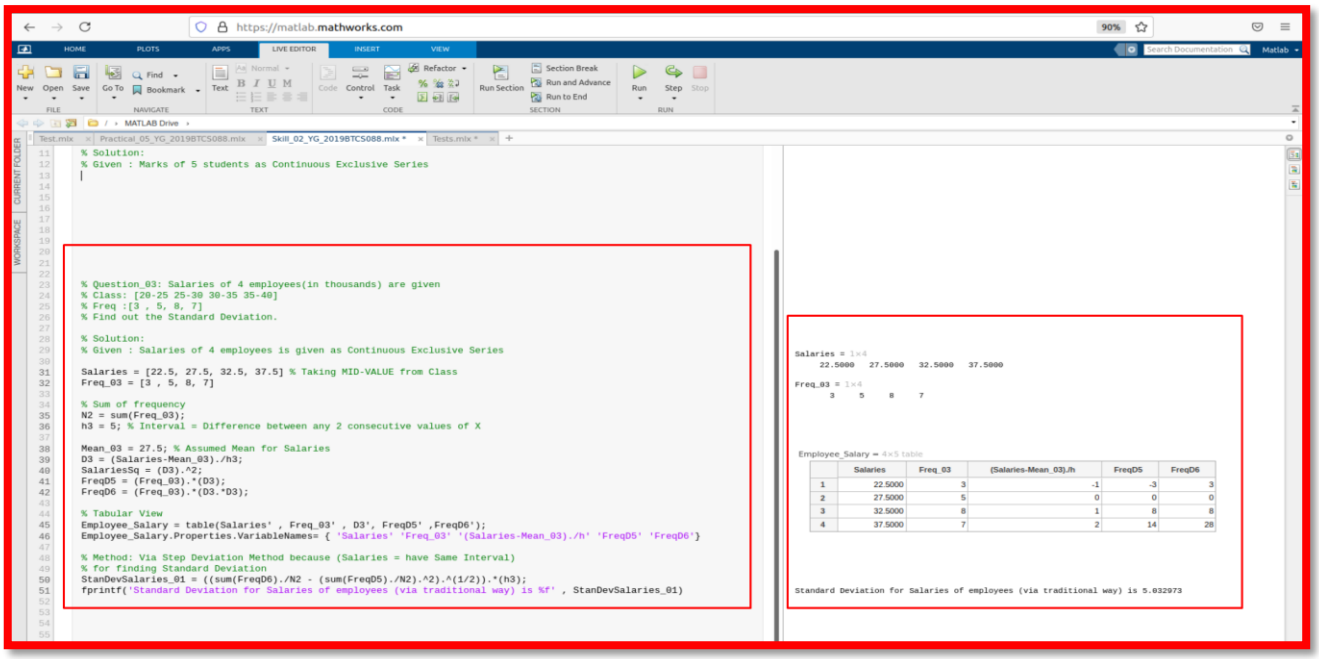
```
% Question_02: Wages of 5 workers are given
% Class : [0-10 10-20 20-30 30-40 40-50 50-60 60-70 70-80]
% Freq : [3, 7, 4, 9, 10]
% Find out the Standard Deviation.

% Solution:
% Given : Wages of 5 workers as Continuous Exclusive Series

Wages = [5, 15, 25, 35, 45, 55, 65, 75] % Taking MID-VALUE from Class
Freq_02 = [15, 15, 23, 22, 25, 10, 5, 10]

% Sum of frequency
N1 = sum(Freq_02);
h2 = 10; % Interval = Difference between any 2 consecutive values of X {15-5=10}

% We will take Assumed Mean for Wages(X)
Mean_02 = 35;
D2 = (Wages-Mean_02)./h2;
WagesSq = (D2).^2;
FreqD3 = (Freq_02).*(D2);
FreqD4 = (Freq_02).*(D2.*D2);

% Tabular View

Worker_Wages = table(Wages' ,Freq_02' , D2' , FreqD3' , FreqD4');
Worker_Wages.Properties.VariableNames= { 'Wages' 'Freq_02'  'Wages-Mean' 'FreqD3' 'FreqD4'}

% Method: Via Assumed Mean Method because (Wages =! have Same Interval)
% for finding Standard Deviation
StanDevWages_01 = ((sum(FreqD4)./N1 - (sum(FreqD3)./N1).^2).^(1/2)).*(h2);
fprintf('Standard Deviation of Wages (via traditional way) is %f' , StanDevWages_01)
```

```
Wages = 1×8
     5    15    25    35    45    55    65    75

Freq_02 = 1×8
    15    15    23    22    25    10     5    10

Worker_Wages = 8×5 table
```

	Wages	Freq_02	Wages-Mean	FreqD3	FreqD4
1	5	15	-3	-45	135
2	15	15	-2	-30	60
3	25	23	-1	-23	23
4	35	22	0	0	0
5	45	25	1	25	25
6	55	10	2	20	40
7	65	5	3	15	45
8	75	10	4	40	160

```
Standard Deviation of Wages (via traditional way) is 19.757895
```

I. Example 3: Standard Deviation for Continuous Series.



```
% Solution:
% Given : Marks of 5 students as Continuous Exclusive Series
```

```
% Question_03: Salaries of 4 employees(in thousands) are given
% Class: [20-25 25-30 30-35 35-40]
% Freq :[3 , 5, 8, 7]
% Find out the Standard Deviation.

% Solution:
% Given : Salaries of 4 employees is given as Continuous Exclusive Series

Salaries = [22.5, 27.5, 32.5, 37.5] % Taking MID-VALUE from Class
Freq_03 = [3 , 5, 8, 7]

% Sum of frequency
N2 = sum(Freq_03);
h3 = 5; % Interval = Difference between any 2 consecutive values of X

Mean_03 = 27.5; % Assumed Mean for Salaries
D3 = (Salaries-Mean_03)./h3;
SalariesSq = (D3).^2;
FreqD5 = (Freq_03).*(D3);
FreqD6 = (Freq_03).*(D3.*D3);

% Tabular View
Employee_Salary = table(Salaries' , Freq_03' , D3', FreqD5' ,FreqD6');
Employee_Salary.Properties.VariableNames= { 'Salaries' 'Freq_03' '(Salaries-Mean_03)./h' 'FreqD5' 'FreqD6'}

% Method: Via Step Deviation Method because (Salaries = have Same Interval)
% for finding Standard Deviation
StanDevSalaries_01 = ((sum(FreqD6)./N2 - (sum(FreqD5)./N2).^2).^(1/2)).*(h3);
fprintf('Standard Deviation for Salaries of employees (via traditional way) is %f' , StanDevSalaries_01)
```

```
Salaries = 1×4
    22.5000   27.5000   32.5000   37.5000

Freq_03 = 1×4
     3     5     8     7

Employee_Salary = 4×5 table
```

	Salaries	Freq_03	(Salaries-Mean_03)./h	FreqD5	FreqD6
1	22.5000	3	-1	-3	3
2	27.5000	5	0	0	0
3	32.5000	8	1	8	8
4	37.5000	7	2	14	28

```
Standard Deviation for Salaries of employees (via traditional way) is 5.032973
```

-

SKILL ACTIVITIY NO: 3

(Application of Correlation using the MATLAB)

Date: 17th June 2021

SKILL_ACTIVITY_03

Date: 17th June 2021

Title: Application of Correlation using MATLAB

1. What is the purpose of this activity? (Explain in 3-4 lines)

Purpose of this activity is to find out:-

- (a) What is Correlation?; Why we require Correlation?
- (b) Need of correlation in Real world problems.
- (c) 3 values of correlation & their respective graphs
- (d) What do we mean by Correlation coefficient?

2. Steps performed in this Activity. (Explain in 5-6 lines)

To find out correlation in MATLAB we have two ways

(a) → via using pre-created function 'corrcoef()'

(b) → via using mathematical formula i.e.

$$\text{Correlation } (r_{xy}) = \frac{n\Sigma(x.y) - \Sigma y.\Sigma x}{\left(\sqrt{n\Sigma x^2 - (\Sigma x)^2}\right)\left(\sqrt{n\Sigma y^2 - (\Sigma y)^2}\right)}$$

Method 1: //MATLAB Function

So for finding correlation via using corrcoef()

→ Then simply provide the 'x' & 'y' as ARGUMENT to corrcoef( ), x, y function.

Method 2: Via Traditional Mathematical Formula we have to perform certain steps.

Step①: Obtain a data sample with the values of x-variable & y-variable & store them in an array.

Step②: Calculate the sum of 'x' variable, 'y' variable using sum( ) of matlab

Step③: Now, according to mathematical formula, same we have to multiply the variable's such as mentioned in the above formula.

Step④: After that, find the square Root of the value obtained by squaring the each value & calculating the sum of the Result.

Step⑤: Divide the value obtained in (Step③) by the value obtained in Step④.

Method 3: In order to calculate the correlation using the below formula, we have to perform following steps:

Step 1. Obtain a data sample with the values of x-variable & y-variable

Step 2: Calculate the means (average) $\bar{x}$ for the x variable & $\bar{y}$ for the y variable

Step 3: For the x-variable, subtract the mean from each value of the x-variable (let's call) this new variable 'MN_SPEED'. Do the same for the y-variable (let's call this variable 'MN_Apple')

Step 4: Multiply each a value by the corresponding b-value & find the sum of these multiplications (the final value is the Numerator in the formula)

Step 5: Square each-a value & calculate the sum of the Result.

Step 6: Find the square root of the value obtained in the previous step (this is the denominator in the formula)

Step 7: Divide the value obtained in step 4 by the value obtained in step 7

Formula we used:

$$r_{xy} = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

x_i, y_i → Denotes the values of the X & Y-variable in sample

$\bar{x}$, $\bar{y}$ → " " mean " " " "

r_{xy} → The correlation coefficient of the linear relationship b/w variables 'x' & 'y'

3. What Resources/ Materials / Equipments / tools did you use for this activity?

1. Matlab 30-Day Trial software (2021a)
2. Correlation Example from Web

4. What skills did you acquire?

- Get to know about what is correlation?
- Why we need Correlation? (Applications of correlation mostly in machine learning/ Data Science)
- How to use MATLAB pre-defined functions() for finding correlation.
- Usage of corr(), corrcoef() function, Matrix multiplication, Divison
- Use of Table() in MATLAB.

5. Time taken to complete this Activity? 09:00 (HOURS)

Yogesh

Signature of Student

(To be filled by Faculty)

Sr. No.	Skill /Competencies	(Achieved / Not Achieved) (Yes / No)

Remarks :

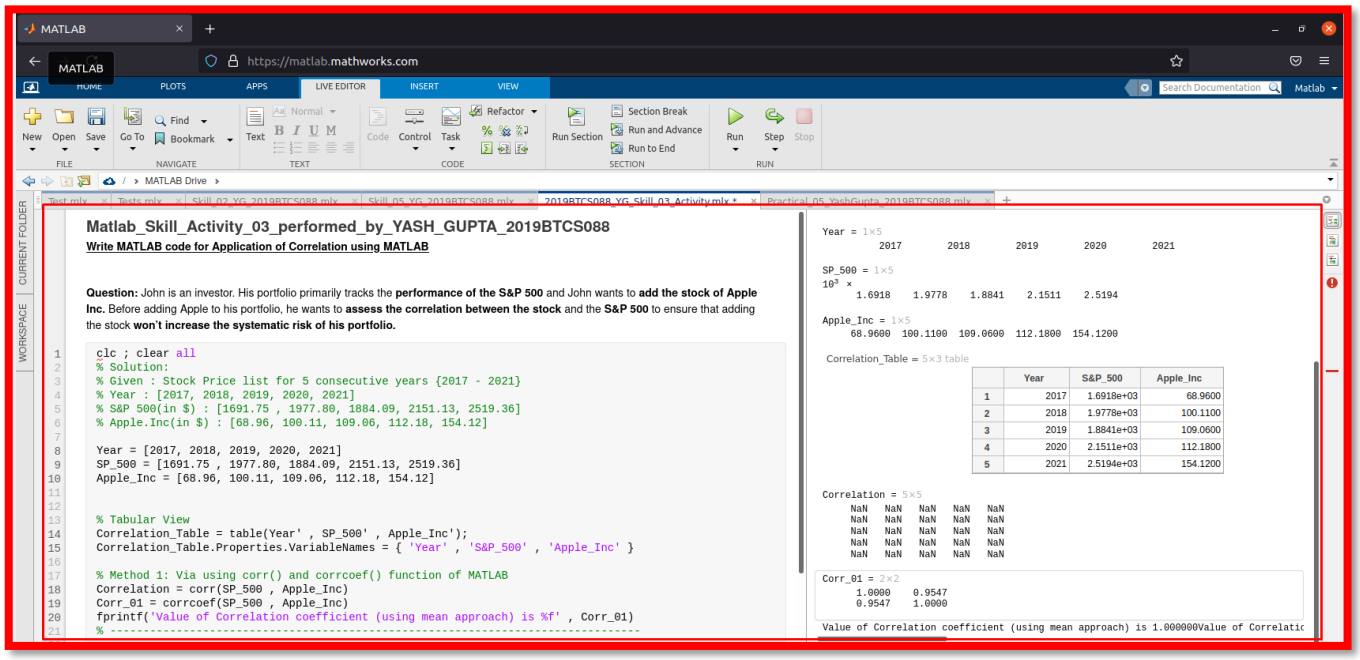
Total mark _____out of 10.

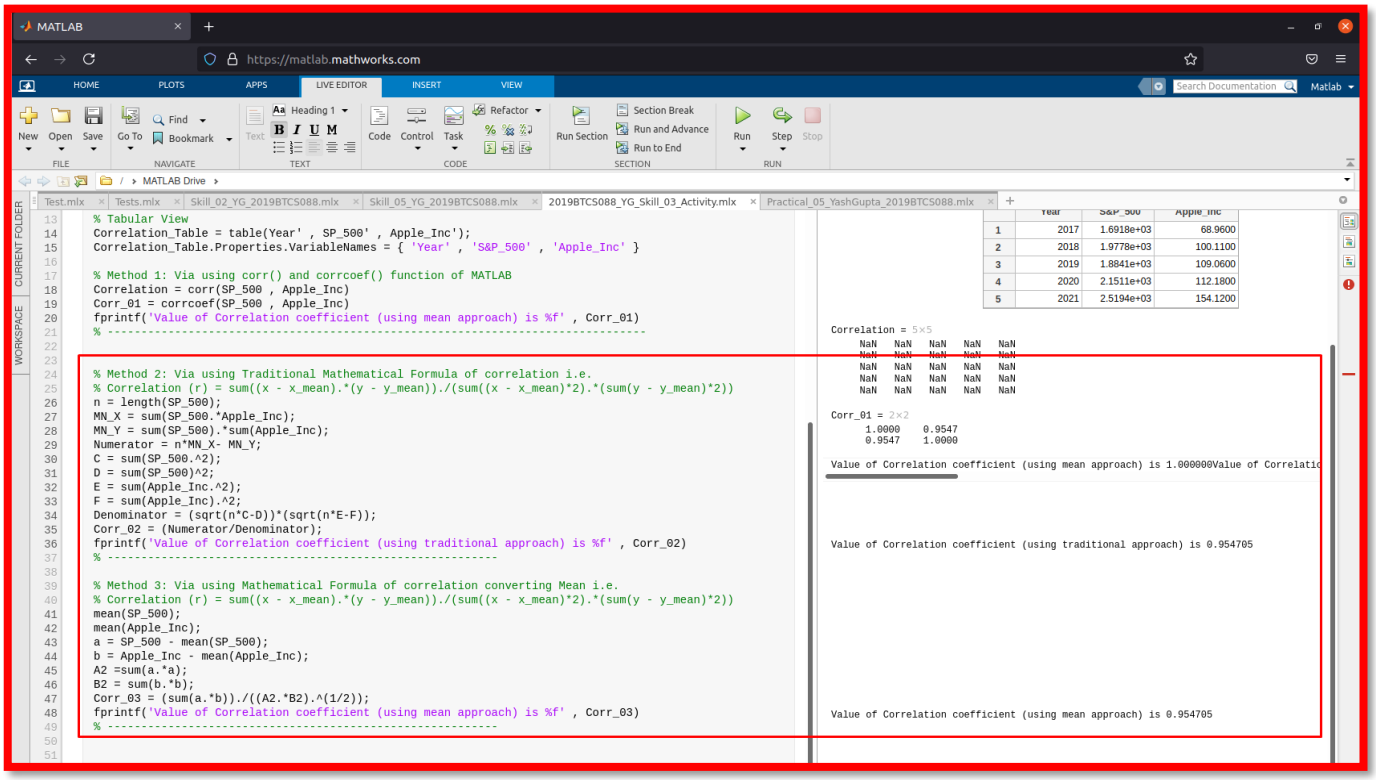
Signature of Faculty

Date: _____

Details of Activity:

MATLAB CODE:





SKILL ACTIVITIY NO: 4

(Application of Curve-fitting for Real-World Problems via MATLAB)

Date: 25-June-2021

SKILL ACTIVITY 04

Date: 25th June 2021

TITLE: Application of Curve Fitting for Real world Problems using MATLAB:

1. What is the purpose of this Activity? (Explain in 3-4 lines)

Purpose of this activity is to find out:-

- (a) what is Curve-fitting? Why we need it?
- (b) Need of Curve-fitting in Real world problems.
- (c) How to find Best fitted curve for any problem?
- (d) How to choose the degree of curve for different kind of problems?

2. Steps performed in this Activity. (Explain in 5-6 lines)

We have given some list of abscissas & ordinates (x_k, y_k) where $k = 0 \dots n$. As 'x' takes values $x_0, x_1, x_2, x_3, \dots, x_n$ then the corresponding values of y are $y_0, y_1, y_2, y_3 \dots, y_n$.

Our goal is to find a curve that is 'BEST FITTED' in the data.

On the basis of degree of curve, we have different types:

- Linear fit → $g(x) = a + bx$
- Parabolic fit → $g(x) = a + bx + cx^2$
- Cubic fit → $g(x) = a + bx + cx^2 + dx^3$
- n^{th} fit → $g(x_n) = a + bx + cx^2 + dx^3 - - -$

Now, in order to find the constants a, b, c, d - - etc. we have to apply some technique which minimizes the error i.e. all given data points are very very close to the curve we are going to find. Hence here we are using is, **Method of Least Squares!**

① For Linear Fit → $g(x) = a + bx$

$$\begin{bmatrix} n & \Sigma x \\ \Sigma x & \Sigma x^2 \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} \Sigma y \\ \Sigma xy \end{bmatrix}$$

② For Parabolic Fit → $g(x) = a + bx + cx^2$

$$\begin{bmatrix} n & \Sigma x & \Sigma x^2 \\ \Sigma x & \Sigma x^2 & \Sigma x^3 \\ \Sigma x^2 & \Sigma x^3 & \Sigma x^4 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} \Sigma y \\ \Sigma xy \\ \Sigma x^2 y \end{bmatrix}$$

③ For Cubic Fit : → $q(x) = a + bx + cx^2 + dx^3$

$$\begin{bmatrix} n & \Sigma x & \Sigma x^2 & \Sigma x^3 \\ \Sigma x & \Sigma x^2 & \Sigma x^3 & \Sigma x^4 \\ \Sigma x^2 & \Sigma x^3 & \Sigma x^4 & \Sigma x^5 \\ \Sigma x^3 & \Sigma x^4 & \Sigma x^5 & \Sigma x^6 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} = \begin{bmatrix} \Sigma y \\ \Sigma y^2 \\ \Sigma y^3 \\ \Sigma y^4 \end{bmatrix}$$

——— x ———

As mentioned above, we have to solve Real world problem using Curve fitting - hence, we took a problem related to Mechanical Characteristics of Bituminous

Step①: Here, we have Strain – Amplitude as "x" and
Complex – Modulus as "y"

Step②: we used the polyval( ) as well as polyfit( ) of MATLAB.

polyval( ) → For evaluating the polynomial means it provides the value of constants.

polyfit( ) → For Least-Square polynomial curve fitting ← Provides Best Fitted Curve.

plot( ) → For plotting the curve.

Step③: After writing code, we have changed the degree of polynomial manually in order to find the BEST CURVE Fitted

↳ we changed from 1 → 2 → 3 → 5 → 10

↳ found the most accurate line / Best-fitted line!

3. What Resources/ Materials/ Equipment's / Tools did you use for this activity?

1. Matlab 30-Days Trial Software (2021a)
2. Plot(), polyval() & polyfit() from Matlab Help.
3. Data from NPTEL course i.e. Mechanical Characterization of Bituminous.

4. What skills did you acquire?

↳ Get to know about what, why when to use curve fitting?
↳ Applications of curve-fitting
↳ How to use MATLAB pre-defined func. for curve fitting
↳ Usage of plot(), polyval() & polyfit() in MATLAB

5. Time taken to complete this Activity? 03:00(HOURS)

Signature of Student

(To be filled by Faculty)

Sr. No.	Skill /Competencies	(Achieved / Not Achieved) (Yes / No)

Remarks :

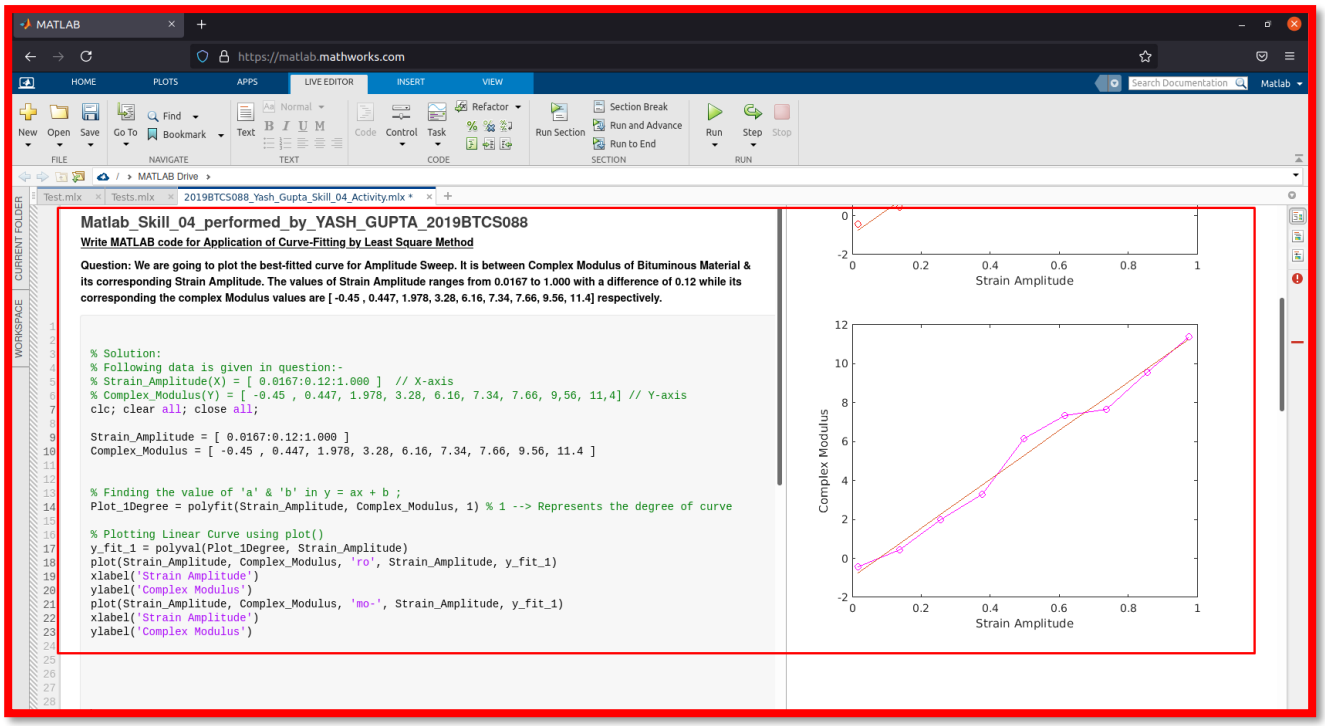
Total mark _____out of 10.

Signature of Faculty

Date: _____

Details of Activity:

MATLAB CODE:

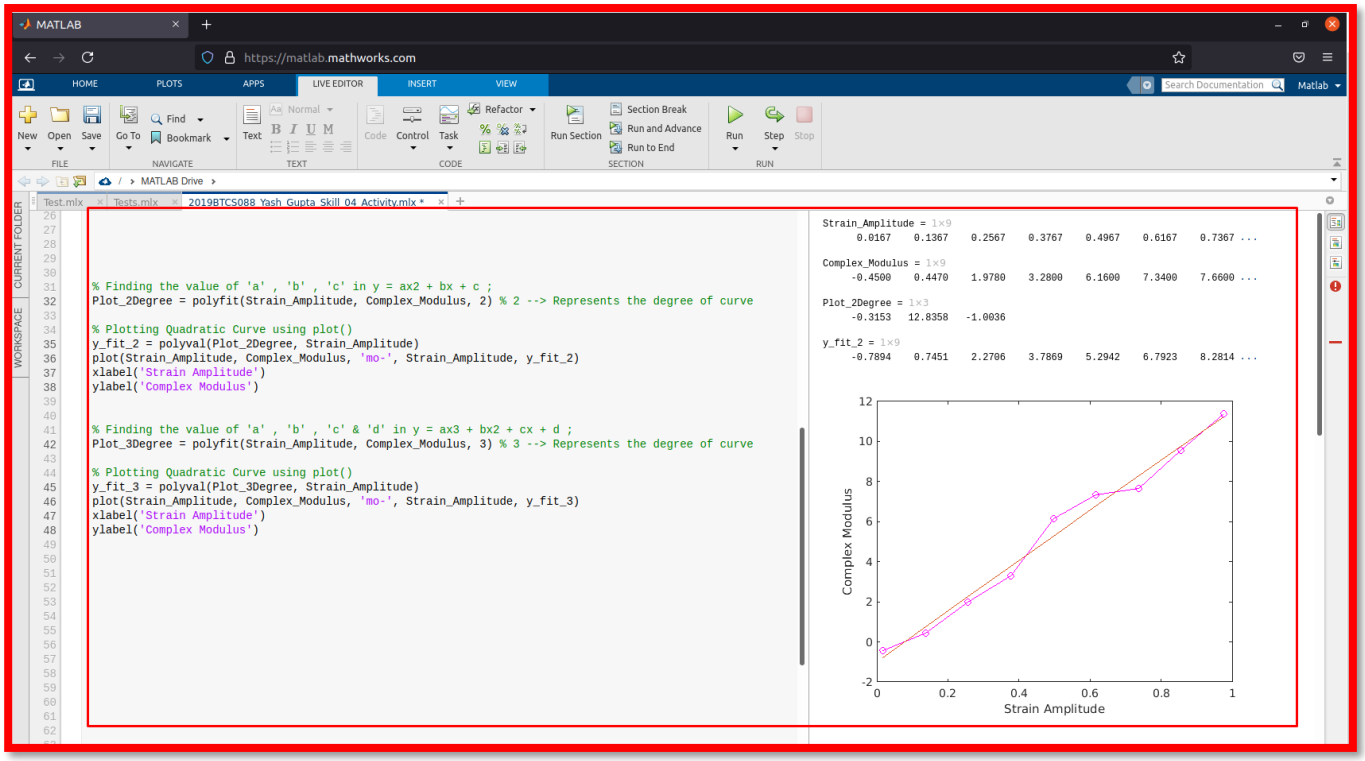


Matlab_Skill_04_performed_by_YASH_GUPTA_2019BTCS088

Write MATLAB code for Application of Curve-Fitting by Least Square Method

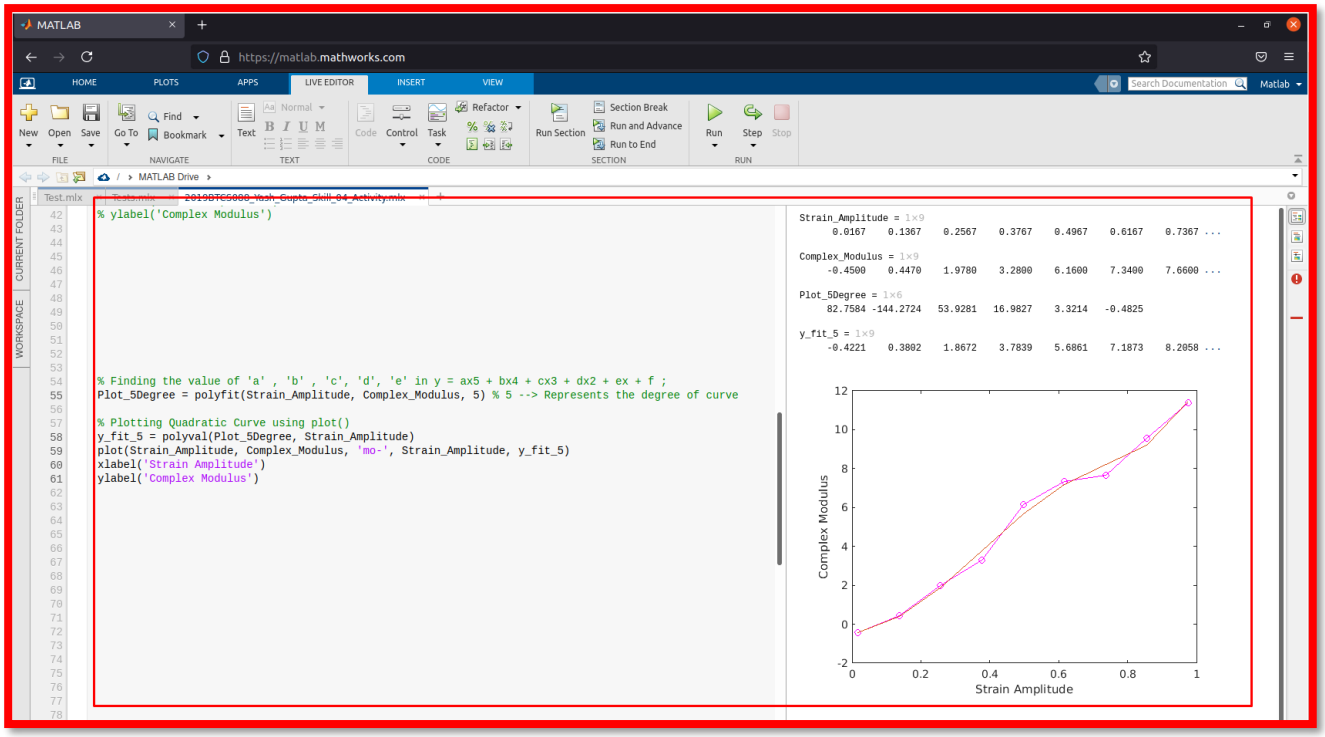
Question: We are going to plot the best-fitted curve for Amplitude Sweep. It is between Complex Modulus of Bituminous Material & its corresponding Strain Amplitude. The values of Strain Amplitude ranges from 0.0167 to 1.000 with a difference of 0.12 while its corresponding the complex Modulus values are [-0.45 , 0.447, 1.978, 3.28, 6.16, 7.34, 7.66, 9.56, 11.4] respectively.

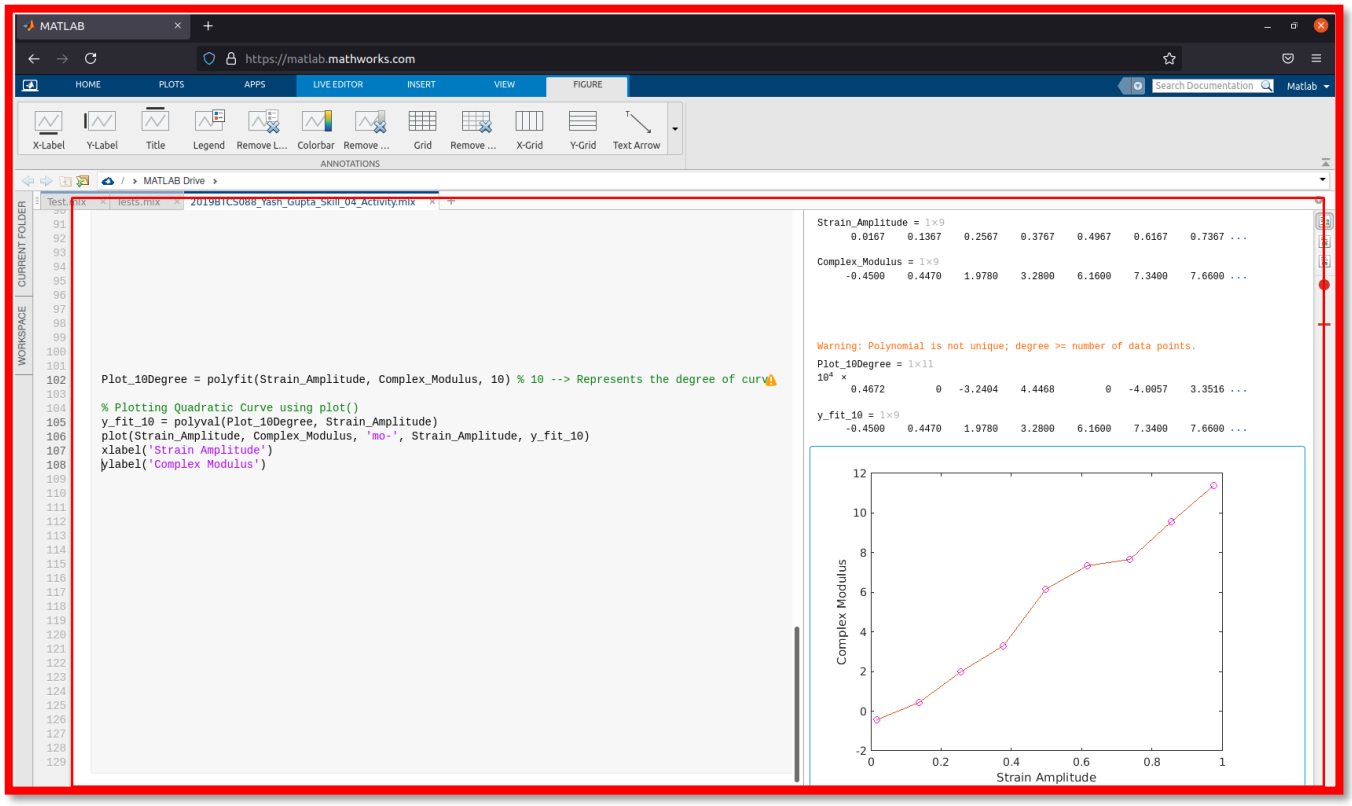
```
% Solution:
% Following data is given in question:-
% Strain_Amplitude(X) = [ 0.0167:0.12:1.000 ]  // X-axis
% Complex_Modulus(Y) = [ -0.45 , 0.447, 1.978, 3.28, 6.16, 7.34, 7.66, 9,56, 11,4] // Y-axis
clc; clear all; close all;

Strain_Amplitude = [ 0.0167:0.12:1.000 ]
Complex_Modulus = [ -0.45 , 0.447, 1.978, 3.28, 6.16, 7.34, 7.66, 9.56, 11.4 ]


% Finding the value of 'a' & 'b' in y = ax + b ;
Plot_1Degree = polyfit(Strain_Amplitude, Complex_Modulus, 1) % 1 --> Represents the degree of curve

% Plotting Linear Curve using plot()
y_fit_1 = polyval(Plot_1Degree, Strain_Amplitude)
plot(Strain_Amplitude, Complex_Modulus, 'ro', Strain_Amplitude, y_fit_1)
xlabel('Strain Amplitude')
ylabel('Complex Modulus')
plot(Strain_Amplitude, Complex_Modulus, 'mo-', Strain_Amplitude, y_fit_1)
xlabel('Strain Amplitude')
ylabel('Complex Modulus')
```

```
% Finding the value of 'a' , 'b' , 'c' in y = ax2 + bx + c ;
Plot_2Degree = polyfit(Strain_Amplitude, Complex_Modulus, 2) % 2 --> Represents the degree of curve

% Plotting Quadratic Curve using plot()
y_fit_2 = polyval(Plot_2Degree, Strain_Amplitude)
plot(Strain_Amplitude, Complex_Modulus, 'mo-', Strain_Amplitude, y_fit_2)
xlabel('Strain Amplitude')
ylabel('Complex Modulus')


% Finding the value of 'a' , 'b' , 'c' & 'd' in y = ax3 + bx2 + cx + d ;
Plot_3Degree = polyfit(Strain_Amplitude, Complex_Modulus, 3) % 3 --> Represents the degree of curve

% Plotting Quadratic Curve using plot()
y_fit_3 = polyval(Plot_3Degree, Strain_Amplitude)
plot(Strain_Amplitude, Complex_Modulus, 'mo-', Strain_Amplitude, y_fit_3)
xlabel('Strain Amplitude')
ylabel('Complex Modulus')
```

```
Strain_Amplitude = 1×9
    0.0167    0.1367    0.2567    0.3767    0.4967    0.6167    0.7367 ...

Complex_Modulus = 1×9
   -0.4500    0.4470    1.9780    3.2800    6.1600    7.3400    7.6600 ...

Plot_2Degree = 1×3
   -0.3153   12.8358   -1.0036

y_fit_2 = 1×9
   -0.7894    0.7451    2.2706    3.7869    5.2942    6.7923    8.2814 ...
```


MATLAB
https://matlab.mathworks.com
% ylabel('Complex Modulus')
% Finding the value of 'a' , 'b' , 'c', 'd', 'e' in y = ax5 + bx4 + cx3 + dx2 + ex + f ;
Plot_5Degree = polyfit(Strain_Amplitude, Complex_Modulus, 5) % 5 --> Represents the degree of curve
% Plotting Quadratic Curve using plot()
y_fit_5 = polyval(Plot_5Degree, Strain_Amplitude)
plot(Strain_Amplitude, Complex_Modulus, 'mo-', Strain_Amplitude, y_fit_5)
xlabel('Strain Amplitude')
ylabel('Complex Modulus')
Strain_Amplitude = 1×9
0.0167 0.1367 0.2567 0.3767 0.4967 0.6167 0.7367 ...
Complex_Modulus = 1×9
-0.4500 0.4470 1.9780 3.2800 6.1600 7.3400 7.6600 ...
Plot_5Degree = 1×6
82.7584 -144.2724 53.9281 16.9827 3.3214 -0.4825
y_fit_5 = 1×9
-0.4221 0.3802 1.8672 3.7839 5.6861 7.1873 8.2058 ...
Complex Modulus
Strain Amplitude


MATLAB
https://matlab.mathworks.com
Plot_10Degree = polyfit(Strain_Amplitude, Complex_Modulus, 10) % 10 --> Represents the degree of curv
% Plotting Quadratic Curve using plot()
y_fit_10 = polyval(Plot_10Degree, Strain_Amplitude)
plot(Strain_Amplitude, Complex_Modulus, 'mo-', Strain_Amplitude, y_fit_10)
xlabel('Strain Amplitude')
ylabel('Complex Modulus')
Strain_Amplitude = 1×9
0.0167 0.1367 0.2567 0.3767 0.4967 0.6167 0.7367 ...
Complex_Modulus = 1×9
-0.4500 0.4470 1.9780 3.2800 6.1600 7.3400 7.6600 ...
Warning: Polynomial is not unique; degree >= number of data points.
Plot_10Degree = 1×11
10^4 ×
0.4672 0 -3.2404 4.4468 0 -4.0057 3.3516 ...
y_fit_10 = 1×9
-0.4500 0.4470 1.9780 3.2800 6.1600 7.3400 7.6600 ...
Complex Modulus
Strain Amplitude

SKILL ACTIVITIY NO: 5

(Application of Testing of hypothesis using T-Test for Real-World Problems via MATLAB)

Date: 27th June 2021

SKILL_ACTIVITY_05

TITLE: Application of Testing of hypothesis using T-Test for Realworld Problems via MATLAB

Date: 27th June 2021

1. **What is the purpose of this activity? (Explain in 3-4 lines)**

Purpose of this activity is to find out:—

- What does Testing of Hypothesis mean?
- What is t-test? what are its properties?
- How to apply t-test? Where to apply T-test?
- Application of T-test in Real world problems
- How to use MATLAB pre-defined functions for t-test implication?

2. **Steps performed in this Activity. (Explain in 5-6 lines)**

- Step①: Collect the sample dataset for performing T-test.
  - Note: {sample size (≤ 30)} for t-test.
- Step②: Find the Theoretical mean value which was already provided in question.
- Step③: & Define a Null Hypothesis with mean → Theoretical (Actual mean)
- Step④: Then apply below mathematical formula to perform t-test i.e.

$$t = \frac{m - \mu}{s} * \sqrt{n}$$

Here, 'm': represents mean
'μ' — " —— Theoritical mean value
'S' — " —— Standard Deviation
'n' — " —— Variable set size {Total No of observations}

- Step⑤: After calculating 't' value, then find standardt by using tinv( ) of matlab.
  - Function for computing students (t-test) inverse distribution function.
- Step⑥: Then simply compare 't' value & standardt ( ) value
  - if $t <$ standardt ( )
    - Null Hypo → is Accepted
  - else Rejected.

3. What Resources/ Materials/ Equipment's/ Tools did you use for this Activity?

a. Matlab 30 Days Free Trial Software (2021a)
b. Matlab Online Help Documentation
c. Realworld Dataset of COVID-19 SecondWave-M.P Dataset

4. What skills did you acquire?

- How to apply t-test in Realworld problems?
- Usecase of Testing of Hypothesis.
- Properties of (t-test) & ~~WHS~~ W5HH regarding (t-test)
- Use of t-test in covid-19 dataset {Related to Deaths of Person}

5. Time taken to perform this activity? 05:00 (HOURS)

Yguptа

Signature of Students

———×———

(To be filled by Faculty)

Sr. No.	Skill /Competencies	(Achieved / Not Achieved) (Yes / No)

Remarks :

Total mark _____out of 10.

Signature of Faculty

Date: _____

Details of Activity:

MATLAB CODE: