LAB # 01

Spring 2024

Signals & Systems Lab

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Class Section: **A**

"On my honor, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work."

Submitted to:

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Lab Objectives:

The primary objectives of this lab are as follows:

- Gain familiarity with MATLAB and its environment.
- Learn basic MATLAB commands and functions.
- Understand variable arithmetic and mathematical operations.
- Explore input and display functionalities.
- Utilize timing commands to measure execution time.
- Create and execute M-files for storing and executing commands.

Task 01: Variable Manipulation and Formatting:

Code Screenshot 1:

```
% Try the Simple Code

x=-130000 %store value of x
whos %info about variable x
y=int8(x)
whos %info about y
```

Output:

```
x =
   -130000
  Name      Size            Bytes  Class     Attributes
  x         1x1                 8  double

y =
  -128
  Name      Size            Bytes  Class     Attributes
  x         1x1                 8  double
  y         1x1                 1  int8
```

Code Screenshot 2:

```
name='Hassan'
%name stores string of my name
int8=int8(name)
%converting Each character into 8 bit integer representation
disp('name')
%Display Name
```

Output

```
name =

Hassan


int8 =

   72   97  115  115   97  110
```

Code Screenshot 03:

```
time=clock;
%Taking Date & Time;

fix_time=floor(time);
%floor is converting it to nearest integer;

disp(fix_time)
%It will show rounded/fixed time;
```

Output:

```
2024     3     3     1    56    31
```

Task 02: M-File Creation and Expression Evaluation:

I have written code for six identities

.

Screenshot:

```
tic

a = 1;
b = 2;
x = 0.000000000000001;

% Identity No 1, Sin(Alpha+Beta)
LHS_I1 = sin(a + b);
RHS_I1 = sin(a)*cos(b) + cos(a)*sin(b);

if abs(LHS_I1 - RHS_I1) < x
    disp('Identity 1 is satisfied');
else
    disp('Identity 1 is NOT satisfied');
end

% Identity No 2, Cos(Alpha+Beta)
LHS_I2 = cos(a + b);
RHS_I2 = cos(a)*cos(b) - sin(a)*sin(b);

if abs(LHS_I2 - RHS_I2) < x
    disp('Identity 2 is satisfied');
else
    disp('Identity 2 is NOT satisfied');
end

% Identity No 3, Sin(Alpha)+Sin(Beta)
LHS_I3 = sin(a) + sin(b);
RHS_I3 = 2*sin((a + b)/2)*cos((a - b)/2);

if abs(LHS_I3 - RHS_I3) < x
    disp('Identity 3 is satisfied');
else
    disp('Identity 3 is NOT satisfied');
end

% Identity No 4, Tan(Alpha+Beta)
LHS_I4 = tan(a + b);
RHS_I4 = (tan(a) + tan(b))/(1 - tan(a)*tan(b));

if abs(LHS_I4 - RHS_I4) < x
    disp('Identity 4 is satisfied');
else
```

Output:

```
Command Window
Identity 1 is satisfied
Identity 2 is satisfied
Identity 3 is satisfied
Identity 4 is satisfied
Identity 5 is satisfied
Identity 6 is satisfied
Elapsed time is 0.000089 seconds.
```

```
    disp('Identity 4 is NOT satisfied');
end

% Identity No 5, Sin(Alpha)*Sin(Beta)
LHS_I5 = sin(a)*sin(b);
RHS_I5 = (1/2)*(cos(a - b) - cos(a + b));

if abs(LHS_I5 - RHS_I5) < x
    disp('Identity 5 is satisfied');
else
    disp('Identity 5 is NOT satisfied');
end

% Identity No 6, Sin(Alpha)Cos(Beta)
LHS_I6 = sin(a)*cos(b);
RHS_I6 = (1/2)*(sin(a + b) + sin(a - b));

if abs(LHS_I6 - RHS_I6) < x
    disp('Identity 6 is satisfied');
else
    disp('Identity 6 is NOT satisfied');
end

toc
```

Task 03: CGPA Calculator:

Output:

```
Enter Grade Points & Credit Hours
Enter Grade Points for Subject 1: 3
Enter Credit Hours for Subject 1: 1
Enter Grade Points for Subject 2: 3
Enter Credit Hours for Subject 2: 3
Enter Grade Points for Subject 3: 3
Enter Credit Hours for Subject 3: 3

Transcript - Second Semester
-----------------------------------
Subject     Grade Point Credit Hours
-----------------------------------
Subject 1   3.00        1
Subject 2   3.00        3
Subject 3   3.00        3
-----------------------------------
Total               7
CGPA: 3.00
-----------------------------------
Equivalent Grade Table
==========================
 Grade  Grade Point
==========================
 A  4.00
 A- 3.67
 B+ 3.33
 B  3.00
 B- 2.67
 C+ 2.33
 C  2.00
 C- 1.67
 D+ 1.33
 D  1.00
 F  0
==========================
```

Code:

See next page for complete cod of this task.

```
% CGPA Calculator Program
fprintf('Enter Grade Points & Credit Hours\n')

GP_1 = input('Enter Grade Points for Subject 1: ');
CH_1 = input('Enter Credit Hours for Subject 1: ');

GP_2 = input('Enter Grade Points for Subject 2: ');
CH_2 = input('Enter Credit Hours for Subject 2: ');

GP_3 = input('Enter Grade Points for Subject 3: ');
CH_3 = input('Enter Credit Hours for Subject 3: ');
Total_CH = CH_1 + CH_2 + CH_3;
Total_GP = (GP_1 * CH_1) + (GP_2 * CH_2) + (GP_3 * CH_3);
CGPA = Total_GP / Total_CH;
fprintf('\nTranscript - Second Semester\n');
fprintf('-------------------------------------\n');
fprintf('Subject\t\tGrade Point\tCredit Hours\n');
fprintf('-------------------------------------\n');
fprintf('Subject 1\t%.2f\t\t%d\n', GP_1, CH_1);
fprintf('Subject 2\t%.2f\t\t%d\n', GP_2, CH_2);
fprintf('Subject 3\t%.2f\t\t%d\n', GP_3, CH_3);
fprintf('-------------------------------------\n');
fprintf('Total\t\t\t\t%d\n', Total_CH);
fprintf('CGPA: %.2f\n', CGPA);
fprintf('-------------------------------------\n');

% Equivalent Grade Table
fprintf('Equivalent Grade Table\n');
fprintf('==========================\n');
fprintf(' Grade\tGrade Point\n');
fprintf('==========================\n');
fprintf(' A\t4.00\n');
fprintf(' A-\t3.67\n');
fprintf(' B+\t3.33\n');
fprintf(' B\t3.00\n');
fprintf(' B-\t2.67\n');
fprintf(' C+\t2.33\n');
fprintf(' C\t2.00\n');
fprintf(' C-\t1.67\n');
fprintf(' D+\t1.33\n');
fprintf(' D\t1.00\n');
fprintf(' F\t0\n');
fprintf('==========================\n');
```

Task 04: Variable Swapping:

Code:

```
tic
a=10;
b=20;
disp(['Before swapping:a= ' num2str(a) ', b= ' num2str(b)]);
a=a+b;
b=a-b;
a=a-b;
disp(['After swapping: a= ' num2str(a) ', b= ' num2str(b)]);
toc
```

Output:

```
Before swapping:a= 10, b= 20
After swapping: a= 20, b= 10
Elapsed time is 0.025896 seconds
>>
```

Task 05: Pythagoras Theorem Implementation:

Code:

```
base = input('Enter the length of base: ');
per = input('Enter the length of perpendicular side: ');
hypotenuse = sqrt(base^2 + per^2);
fprintf('The length of the hypotenuse is: %.2f\n', hypotenuse);
```

Output:

```
Enter the length of base: 4
Enter the length of perpendicular side: 3
The length of the hypotenuse is: 5.00
```

Task 06: Temperature Conversion:

Code:

```
Tf=input('Enter Temperature In Farenheit ');
Tc=5/9*(Tf-32)
```

Output:

```
Enter Temperature In Farenheit 100

Tc =

   37.7778
```

Task 07: Data Normalization Algorithm:

Code:

```
inputs=zeros(1, 10);
for i=1:10
    inputs(i)=input(['Enter input ' num2str(i) ': ']);
end
max_val=max(inputs);
min_val=min(inputs);
normalized_inputs=(inputs - min_val)/(max_val - min_val);
disp('Normalized values between 0 and 1:');
disp(normalized_inputs);
```

Output:

```
Enter input 1: 4
Enter input 2: 2
Enter input 3: 3
Enter input 4: 5
Enter input 5: 6
Enter input 6: 7
Enter input 7: 8
Enter input 8: 12
Enter input 9: 14
Enter input 10: 4
Normalized values between 0 and 1:
  Columns 1 through 7

    0.1667         0    0.0833    0.2500    0.3333    0.4167    0.5000

  Columns 8 through 10

    0.8333    1.0000    0.1667
```

Conclusion:

Through the completion of various tasks and exercises in the Signals and Systems lab, I have developed a robust understanding of MATLAB's functionalities and applications. From basic commands to advanced variable manipulation and M-file creation, this experience has equipped me with essential skills crucial for data analysis and numerical computation. Experimenting with different data types like int8, uint16, uint32, and uint64 allowed me to grasp the nuances of memory allocation and data representation in MATLAB, providing invaluable insights into optimizing computational efficiency.