Short Term Training Program on
"**MATLAB**",
In collaboration with NITTTR, Chandigarh

MATLAB Essentials

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MATLAB as Scratchpad

Calculate the area of a circle with a radius of 2.5 m.

```
» area = pi * 2.5^2
area =
        19.6350
```

Play with Variables

Suppose that $x = 3$ and $y = 4$. Use MATLAB to evaluate the following expression:

$$\frac{x^2y^3}{(x-y)^2}$$

```
» x = 3;
» y = 4;
» res = x^2 * y^3 / (x - y)^2
res =
    576
```

Play with Variables

The distance traveled by a ball falling in the air is given by the equation

$$x = x_0 + v_0 t + \frac{1}{2}at^2$$

Use MATLAB to calculate the position of the ball at time $t = 5$ s if $x_0 = 10$ m, $v_0 = 15$ m/s, and $a = -9.81$ m/sec^2.

```
» t = 5;
» x0 = 10;
» v0 = 15;
» a = -9.81;
» x = x0 + v0 * t + 1/2 * a * t^2
x =
  -37.6250
```

Vector Exercises

- Create vector *a* of 9 elements
- Add 2 to each element and name this vector as *b*
- Take square of each element
- Create a new vector *c* formed by multiplying each element of *b* by 2

Solution

```
>>a=[1 2 3 4 5 6 4 3 4 5]
>> b=a+2
>> b.^2
>> c=b * 2
```

Matrix Exercises

- 1. Create matrix, *A*, of order 3,3
- 2. Take it's transpose and name it *B*
- 3. Multiply *A* and *B* and assign to *C*
- 4. Multiply corresponding elements of *A* with those of *B*
- 5. Add *A* and *B* and assign to *D*
- 6. Subtract *B* from *A* and assign result to *D*
- 7. Take inverse of A and name it *X*
- 8. Illustrate the fact that a matrix multiplied by it's inverse is identity matrix
- 9. Take square of matrix A
- 10. Find 4th power of matrix B
- 11. Create matrix of order 3,3 with each diagonal element=1

Matrix Exercises Solution

- A=[1 2 0; 2 5 –1; 4 10 –1] %create matrix of order 3,3
- B=A' %take it's transpose
- C=A * B %multiply A and B and assign to C
- C=A .* B %multiply corresponding elements of A with those of B
- D=A + B %add A and B and assign to D
- D=A – B %subtract B from A and assign result to D
- X=inv(A) % Take inverse of A
- I=inv(A) * A %Illustrate the fact that a matrix multiplied by it's inverse is identity matrix
- A.^2 %Take square of matrix A
- B.^4 %Find 4th power of matrix B
- diag([ones(1,3)] %create matrix of order 3,3 with each diagonal element=1

2D Plot Exercises

1. Plot x versus y for $y = \sin(x)$. Let x vary from 0 to 2π in increments of 0.1π.
2. Add a title and labels to your plot.
3. Plot x versus y_1 and y_2 for $y_1 = \sin(x)$ and $y_2 = \cos(x)$. Let x vary from 0 to 2π in increments of 0.1π. Add a title and labels to your plot.
4. Re-create the plot from Exercise 3, but make the $\sin(x)$ line dashed and red. Make the $\cos(x)$ line green and dotted.
5. Add a legend to the graph in Exercise 4.
6. Adjust the axes so that the x-axis goes from -1 to $2\pi + 1$ and the y-axis from -1.5 to $+1.5$.
7. Create a new vector, `a = cos(x)`. Let **x** vary from 0 to 2π in increments of 0.1π. Plot just `a` without specifying the x values (`plot(a)`) and observe the result. Compare this result with the graph produced by plotting x versus `a`.

2D Plot Solutions

1.
```
clear,clc
x = 0:0.1*pi:2*pi;
y = sin(x);
plot(x,y)
```

2.
```
title('Sinusoidal Curve')
xlabel('x values')
ylabel('sin(x)')
```

3.
```
figure(2)
y1 = sin(x);
y2 = cos(x);
plot(x,y1,x,y2)
title('Sine and
  Cosine Plots')
xlabel('x values')
ylabel('y values')
```

4.
```
figure(3)
plot(x,y1,'-- r',
  x,y2,': g')
title('Sine and Cosine
  Plots')
xlabel('x values')
ylabel('y values')
```

5.
```
legend('sin(x)','cos(x)')
```

6.
```
axis([-1,2*pi+1,
  -1.5,1.5])
```

7.
```
figure(4)
a = cos(x);
plot(a)
```

A line graph is created, with a plotted against the vector index number.