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Unit 1: Introduction to matlab

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- Using MATLAB Scratch Pad.
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- Scalar and Array operations.

Unit 2: Introduction to digital Image Representation.

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- Digital Image representation.
- Reading, writting and displaying images.
- Data classes and Image types.
- Converting between data ~~access~~ classes and image types.
- Introduction to M-function programming.

Unit 3: Intensity Transformation and Spatial Filtering

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- Intensity Transformation functions.
  a) using imadjust()
  b) using log()
- Histogram processing and function ploting.
- Spatial filtering.
  a) Linear spatial filtering.
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Unit 4: Frequency Domain Processing.

- Introduction discrete Fourier Transformation (DFT).
- Computing and visualizing 1D-DFT.

- Computing and visualizing 2D - DFT.
- Filtering in frequency domain.

Unit 5 : Image Restoration

- A model of Image degradation / Restoration process.
- Noise models.
- Restoration Technics.
- Geomatric Transformation.
- Image Registration.

Same answer for both

Unit 6 : Color Image Processing.

- Color Image Representation.
- Converting to other color spaces.
- The basics of color Image processing.
- Spatial filtering of color Images.

Same

Reference Book:

Digital Image Processing using matlab.
– R.C. Gonzalez.

★ Introduction:

- Matlab (matrix laboratries) is a special purpose computer program developed to perform engineering and scientific calculations.
- It was started as a program to perform matrix operations, but over the years it has grown into a flexible computing system which can solve any technical problem.
- The matlab programming language provides an extensive library of predefined functions to make the task more easier and efficient.
- It has more than thousounds of functions so matlab can be used in wide area like Aeronatical science, Bioinfonetics, Image processing, nural network etc.

★ Advantages and Disadvantages of matlab:

★ Advantages:

(i) Ease of use:

- Matlab is an interpreted language and is very easy to use.
- The programs can be used as a scratch pad to evaluate expressions typed on the Command line.
- Programs can be easily written and modified with the IDE.
- Many program development tools are provided to make the programs easy.

- It include an intigrated editior, online documention, workspace browers and extensive demos.

② Platform Independence:

- matlab is supported on many different computer systems.
- The language is supported on windows NT / 2000 / XP, Linux, several versions of Unix and macintosh.
- Programs written on any platform will run on any other platform.
- The data files written on any platform may also be read on other platforms.

③ Predefined Functions:

- Matlab comes with an extensive library of predefined functions in most languages.
- You need to write down your programs to perform calculations such as arithemetic mean, median, standard devices.
- These functions are built into matlab making your job easier.
- In addition to these functions their are many special purpose toolboxes available to solve complex problems in specific areas like signal processing, aerospace, artificial ~~ai~~ neural networks, image processing etc.

④ Device Independent Plotting :

- Unlike most other computer languages matlab has many integral ploting and imaging commands.

- The plots and images can be displged on any graphical output device supported by the computer on which matlab is runing.

⑤ Graphical User Interface :

- matlab includes tools that allow a programer to construct GUI for the program.

- with this feature, the programer can design soffisticated programs that can be operated by inexperienced users.

⑥ matlab Compiler :

- matlab flexibility and platform independence is achieved by compiling matlab programs into a device independent P-code and then interpreting the P-code instructions at runtime.

- This approch is similar to that used by microsofts V.B, JAVA programming language.

* Disadvantages :

- matlab has two principle disadvantages.

① Interpreter :

1) It is an interpreted language there fore can execute more slowly than compiled languages this problem can be resolved by using matlab compiler.

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(2) Cost :

2) The next disadvantage is cost.
A fool copy of matlab is 5 to 10 times more expensive than a convential C compiler.

* matlab Environment :

- The fundamental unit of data in any matlab program is an array.
- Array is a collection of data values organized into rows and columns.
- Indivisual data values can be accessed by including name of array followed by subscripts in paranthesis.
(>> f(25, 9)).
- Even scalars are treated as arrays in matlab
- The matlab desktop contains windows showing matlab data, toolbars and the 'start' button.
- By default most tools are docked on to the desktop.
- The measu major tools within matlab desktop are.

1) The command window.
2) The command History window.
3) The workspace Browser.
4) The current directory window.
5) The Editior window.
6) The figure window.
7) The start button, the help and path Browsers.

1) The command window :

- In command window, the user can enter interactive commands of matlab at command prompt (>>).
- The output is also shown in the same window.

2) The command History window :

- This window contains the command that are entered upto the current date.
- You can execute these commands from this window by just a double click.

3) The workspace Browser :

- It shows the variable existing in the memory.
- matlab defines workspace as a set of variables that the user creates in a work-session.
- Double clicking on a variable in the workspace window will open an array editor window.
- It displays data within the variables

4) The current directory window :

- It shows the current Path.
- You can set a new path using browse button.

5) The Editor window :

- This window is used for creating m-files and m-functions.

- The editor window is opened by clicking on file arrow → new → script.
- m-files are denoted by the extension .m.
- This window contains different features.

6) The figure window :

- It displays figures or graphs.
- By default, a single figure is displayed in single figure window.
- However you can use 'figure' keyword to display mutiple images in mutiple figure window.

7) The start button, the help and path browsers :

- The start button of matlab contain various options and provide toolboxes related to a perticular area.
- The help button on the toolbar provides help and path browsers set the path.

★ Variables and Arrays :

- An Array is the fundamental unit of data in matlab.
- Arrays can be classified as either vectors or matrices.
- The term vector is usually used to describe an Array with only one dimension while the term matrix is used to describe an array with two or more dimension.

- The size of an Array is specified by a number of rows and columns in it.
- The total number of elements in Array will be the product of rows and columns.
- A matlab variable is a region of memory containing ~~with~~ an array with user specified name.
- Matlab variables must begin with a letter followed by any combination of letters, numbers and the underscore.
- These variables are automatically created when they are initialized.
- There are three common ways to initialize a variable.

① Using the Assignment statement.
② Inputing data into the variable from keyboard
③ Reading data from a file.

1> Using Assignment Statement:

- The simplest way to initialize a variable is to assign one and more values in an assignment statement.
- The general form is:

var = Expression.

- Where var is a variable name and expression may be a scalar, a vector, a matrix or an expression.

Ex:

```
>> x = 89;
>> y = [2 4 5 6]
>> z = [3 4; 6 8]
>> k = x + T;
```

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2) Inputting data into the variable from the keyboard:

- It is possible to prompt a user and initialize a variable with the data entered through keyboard.
- The input function is used for this purpose.
- This function displays a message on the screen and then wait for the response.
- The general form of this function is.

var = input ('message')

Ex:

```
f = input('Enter a number');
```

- The input function can also be used to enter a string value.
- for this you can use the general form as.

var = input ('message', 's')

Ex:

-- To write statements in m file click file → new → script. then enter following statements.

* Program to perform addition of 2 scalar, vectors or matrices:

```
clc
a= input ('Enter first value:');
b= input ('Enter second value:');
C= a+b;
disp ('Addition = ')
disp( c)
```

- Save this file with name 'Addition' and execute it from command window as.

>> Addition ↵

② clc

f = imread (input ('Enter a filename', 's'));

imshow (f).

* Multidimensional Arrays :

- Matlab Arrays can have one or more dimensions.

- matlab allows us to create arrays with as many dimensions as necessary for a given problem.

- These arrays have one subscript for each dimension and an indivisual element is selected by specifing each value for subscript

- The total number of elements in a multidimensional array will be the product of values of each subscript.

Ex:

- suppose we want to create the 3D array with 2 × 3 × 3 subscript then the statement will be.

```
>> a (:, :, 1) = [12 34 45; 67 89 90];
>> a (:, :, 2) = [2 4 5; 6 8 9];
>> a
```

Output

```
a(:, :, 1) =
    12   34   45
    67   89   90
```

a(:,:,2) =

2 4 5
6 8 9

>> whos ↵

output:

Name	Size	Bytes	class
a	2×3×2	96	double

* Scalar and Array Operations :

- calculations are specified in matlab with an assignment statement whose general form is

name = Expression

- The assignment statement calculates the value of expression to the RHS and assigns that value to the variable at LHS.

- This format can be applied to the scalar or array operations.

① Scalar operations :

- The statements given below are the scalar operations.

Ex :

```
>> a = 15 ;  b = 10 ;
>> c = a + 15 ;
>> d = a + c ;
>> P = a * b - ( c * d ) ;
```

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② Array and matrix operations :

- matlab supports two types of operations between arrays as Array and matrix operations.
- Array operations are performed between arrays on an element by element basis whereas matrix operations follow the normal rules of linear algebra.
- Array operations may also occure betn an array and scalar.
- The example of array operation is addition of two matrices and example of matrix operation is multiplication of two arrays
- However, matrix multiplication can be converted to array multiplication using dot (.) operator.

Ex :

```
>> x = [4 5 ; 10 20];
>> Y = [8 9 ; 30 40];
>> z = x + Y;
>> t = x + 20;
>> P = x .* Y;
```