Computer Science II

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COLLEGE OF ENGINEERING - كلية الهندسة
Tikrit University - جامعة تكريت

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Lecture #1

Programming with MATLAB

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1. Introduction

The name MATLAB stands for MATrix LABoratory. MATLAB was written originally to provide easy access to matrix software developed by the LINPACK (linear system package) and EISPACK (Eigen system package) projects.

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming environment. Furthermore, MATLAB is a modern programming language environment: it has sophisticated data structures, contains built-in editing and debugging tools, and supports object-oriented programming. These factors make MATLAB an excellent tool for teaching and research.

1. Introduction (Cont.)

MATLAB has many advantages compared to conventional computer languages (e.g., C, FORTRAN) for solving technical problems. MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. The software package has been commercially available since 1984 and is now considered as a standard tool at most universities and industries worldwide.

2. Using MATLAB as a calculator

As an example of a simple interactive calculation, just type the expression you want to evaluate. Let's start at the very beginning. For example, let's suppose you want to calculate the expression, 1 + 2 × 3. You type it at the prompt command (>>) as follows:

```
>> 1+2*3

ans = 7
```

2. Using MATLAB as a calculator (Cont.)

You will have noticed that if you do not specify an output variable, MATLAB uses a default variable ans, short for answer, to store the results of the current calculation. Note that the variable *ans* is created (or overwritten, if it is already existed). To avoid this, you may assign a value to a variable or output argument name. For example,

>> $x = 1+2*3$

$x = 7$

2. Using MATLAB as a calculator (Cont.)

will result in x being given the value 1 + 2 × 3 = 7. This variable name can always be used to refer to the results of the previous computations. Therefore, computing 4*x* will result in

```
>> 4*x
```

```
ans = 28.0000
```

2. Using MATLAB as a calculator (Cont.)

The basic arithmetic operators are shown in the table below:

Basic arithmetic operators

SYMBOL	OPERATION	EXAMPLE
+	Addition	2 + 3
−	Subtraction	2 − 3
*	Multiplication	2 * 3
/	Division	2/3

3. Creating MATLAB variables

MATLAB variables are created with an assignment statement. The syntax of variable assignment is:

variable name = a value (or an expression)

For example,

>> x = expression

3. Creating MATLAB variables (Cont.)

Where expression is a combination of numerical values, mathematical operators, variables, and function calls. On other words, expression can involve:

- manual entry
- built-in functions
- user-defined functions

3. Creating MATLAB variables (Cont.)

- **Overwriting variable:**

Once a variable has been created, it can be reassigned. In addition, if you do not wish to see the intermediate results, you can suppress the numerical output by putting a semicolon (;) at the end of the line. Then the sequence of commands looks like this:

```
>> t = 5;

>> t = t+1

t =6
```

3. Creating MATLAB variables (Cont.)

- **Error messages:**

If we enter an expression incorrectly, MATLAB will return an error message. For example, in the following, we left out the multiplication sign, *, in the following expression:

```
>> x = 10;

>> 5x

??? 5x
```

Error: Unexpected MATLAB expression.

4.Controlling the hierarchy of operations or precedence

The order in which MATLAB performs arithmetic operations is exactly that taught in high school algebra courses. Exponentiations are done first, followed by multiplications and divisions, and finally by additions and subtractions.

However, the standard order of precedence of arithmetic operations can be changed by inserting parentheses.

4.Controlling the hierarchy of operations or precedence (Cont.)

Hierarchy of arithmetic operations

PRECEDENCE	MATHEMATICAL OPERATIONS
First	The contents of all parentheses are evaluated first, starting from the innermost parentheses and working outward.
Second	All exponentials are evaluated, working from left to right
Third	All multiplications and divisions are evaluated, working from left to right
Fourth	All additions and subtractions are evaluated, starting from left to right

4.Controlling the hierarchy of operations or precedence (Cont.)

For operators of equal precedence, evaluation is from left to right. Now, consider another example:

$$\frac{1}{2+3^2}+\frac{4}{5}\times\frac{6}{7}$$

In MATLAB, it becomes:

```
>> 1/(2+3^2)+4/5*6/7
ans  =
        0.7766
```

4.Controlling the hierarchy of operations or precedence (Cont.)

or, if parentheses are missing,

```
>> 1/2+3^2+4/5*6/7

ans =

    10.157
```