

COURSE CODE: GEE 216
COURSE TITLE: COMPUTER AND COMPUTING
NUMBER OF UNITS: 3 Units
COURSE DURATION: Three hours per week



COURSE LECTURER: **Engr. Obasi Chukwuemeka**

INTENDED LEARNING OUTCOMES

At the completion of this course, students are expected to:

1. Be able to use pseudo-code to design programming solution to some engineering problems
2. Be able to represent programming solution diagrammatically using flowchart
3. Be able to identify key features of MATLAB environment
4. Be able to use MATLAB as a simple calculator
5. Be able to plot different graph types using MATLAB
6. Be able to use MATLAB programming language to develop software solutions to simple engineering problems.

COURSE DETAILS:

Week 1: Learning Pseudo-code as a programming design tool with sample problems and solutions

Week 2 Learning flowchart as a programming design tool with sample problems and solutions

Week 3: Introduction to MATLAB environment/Test 1

Week 4: Basic MATLAB commands

Week 5-6 Plotting graphs in MATLAB/Test 2

Week 7-8: Introduction to MATLAB programming language

Week 9: Programming examples/tutorials/Test 3

Week 10: introduction to Simulink.

Week 11: Final Test/Collation Continuous assessment scores

Week 12 Revision

RESOURCES

• Lecturer's Office Hours:

• Egr. C. C. Obasi Wednesday 1300 hours to 1500 hours

• Egr. S. Ogbikaya Wednesday 1500 hours to 1600 hours

• **Course lecture Notes:** <http://www.edouniversity.edu.ng/oer/>

• Books:

• Ndubuisi Ngene & Gozie Ihekwaaba (2004), *Computational Techniques for Scientist and Engineers*, Kinsman Publishers Limited, Enugu, Nigeria.

- Steven C. Chapra (2012), *Applied Numerical Methods with MATLAB For Engineers and Scientists, Third Edition*, McGraw-Hill Companies, Inc., 1221 Avenue of the Americas, New York, NY 10020.
- David Houcque (2005), *Introduction to MATLAB for Engineering Students*, Northwestern University.

Projects:

- Students will be expected to undertake projects on groups and in individual bases
- All projects must be carried out using MATLAB.

Assignments & Grading

Students will be evaluated based on the following:

- | | | |
|----------------------------------|---|-----|
| 1. Class work/Lecture attendance | - | 5% |
| 2. Assignments | - | 5% |
| 3. Projects | - | 10% |
| 4. Quiz/Test | - | 10% |

All continuous assessment exercises constitute 30% of the final grade
Examination will constitute 70% of the final grade

- **Academic Honesty:** All class work should be done independently, unless explicitly stated otherwise on the assignment handout.
- You may discuss general solution strategies, but must write up the solutions yourself.
- If you discuss any problem with anyone else, you must write their name at the top of your assignment, labeling them “collaborators”.

• NO LATE HOMEWORKS ACCEPTED

- Turn in what you have at the time it’s due.
- All homeworks are due at the start of class.
- If you will be away, turn in the homework early.
- Late Programming Assignments (projects) will not be accepted, but penalized according to the percentages given on the syllabus.

PREAMBLE

Computer is a modern tool for solving problems across various fields of human endeavor. The use of computer has gone beyond Word processing, Gaming and entertainment, Web Surfing, Emails and instant messaging, Air traffic control, Weather and climate management, Car diagnosis, etc., and presently is being applied in industrial automation, instrumentation and control, processing big data and so on.



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Typical computer consist of the hardware and the software. While the hardware consist of the tangible parts, including the CPU, Memory elements, Hard disk, CD ROM drives, Circuitry, etc., the software is the instructions that provide the intelligence that harnesses the functions of all the hardware pieces. This means that both hardware and software must come together for you to have a computer.

The use of computer technology (hardware or software) in solving any given problem is known as computing. Computing could include design and development of software and hardware systems or tools that could be used for different solution based purposes. It could also include the development of structure that could be used for storing, processing and managing information. In today's context, computing has found useful application in scientific research/studies, intelligent system design entertainment and communication.

In this course, we are going to limit the scope of computing to just software analysis and design and the use of advance programming environment and tools that facilitates engineering solution, such as MATLAB.

This course will be divided into three major modules. This present module will cover the first three lecture, that is to say lectures on Pseudo-code, Flowchart and Introduction to MATLAB environment, while the remaining other two modules will spread through lecture 4 to lecture 10.

1. TOOLS FOR SOFTWARE ANALYSIS AND DESIGN (Lecture 1)

During program analysis and design, pseudo-code and flowchart have remained the common tools used in this respect.

1.1 PSEUDO-CODE

Pseudo-code is English-like statement that are used to document a program.

Example 1.1.1

We want to compute the area of a right angle triangle. To better understand the problem, we must appreciate what a right angle triangle is.

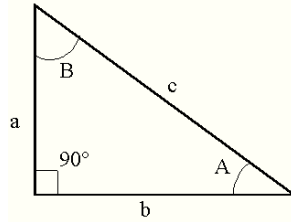


Figure 1.1 Right angle triangle

Understanding the problem

From figure 1 above, a right angle triangle has three sides consisting of the

1. height or opposite side (a),
2. base or adjacent side (b) and
3. hypotenuse (c).

the general formula for calculating the area of triangle is half base times height. That is $\frac{1}{2}ba$.

hence we can write the pseudo-code thus:

1. Get the number of triangles to compute, n
2. Get the base value, b
3. Get the height value, a
4. Compute area = $\frac{1}{2} * b * a$
5. Display the computed area
6. Is number of computations = n
 - a. No repeat from 2
 - b. Yes, skip to 7
7. End

Example 1.1.2

As a general rule, the factorial of n is given by

$$n! = n \times (n-1)!$$

In this case, what we require to perform this computation is just the number n, hence our pseudo-code will be

1. Get the value of n
2. Compute new $n = n - 1$

3. Factorial = $n \times \text{new} - n$
4. Check: if $\text{new} - n = 0$
 - a. Yes, Skip to step 5
 - b. No, repeat from step 2
5. Display Factorial
6. End

Example 1.1.3

We are required to compute the solutions, x , of quadratic equation using formula.

$$x_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$x_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

The Pseudo-code is thus

1. Get the values of a , b , c
2. Get the value of n
3. Compute
 - a. $x_1 = (-b + (\text{sqrt}(b \times b)))/(2 \times a)$
 - b. $x_2 = (-b - (\text{sqrt}(b \times b)))/(2 \times a)$
4. display x_1
5. display x_2
6. $n = n - 1$
7. Check: if $n = 0$
 - a. Yes, Skip to step 8
 - b. No, Repeat from step 3
8. End

1.1.1 Drilling Exercise

Develop the Pseudo-code for the computation of the following:

1. Fibonacci Series
2. The largest and smallest number from a list
3. The average of n numbers.

1.2 FLOWCHART (Lecture 2)

Flowcharts are symbolic or graphical representation of algorithms.

1.2.1 Solved Examples

Example 1.2.1:

Develop a flowchart for the computation of the average score of 50 students in a course.

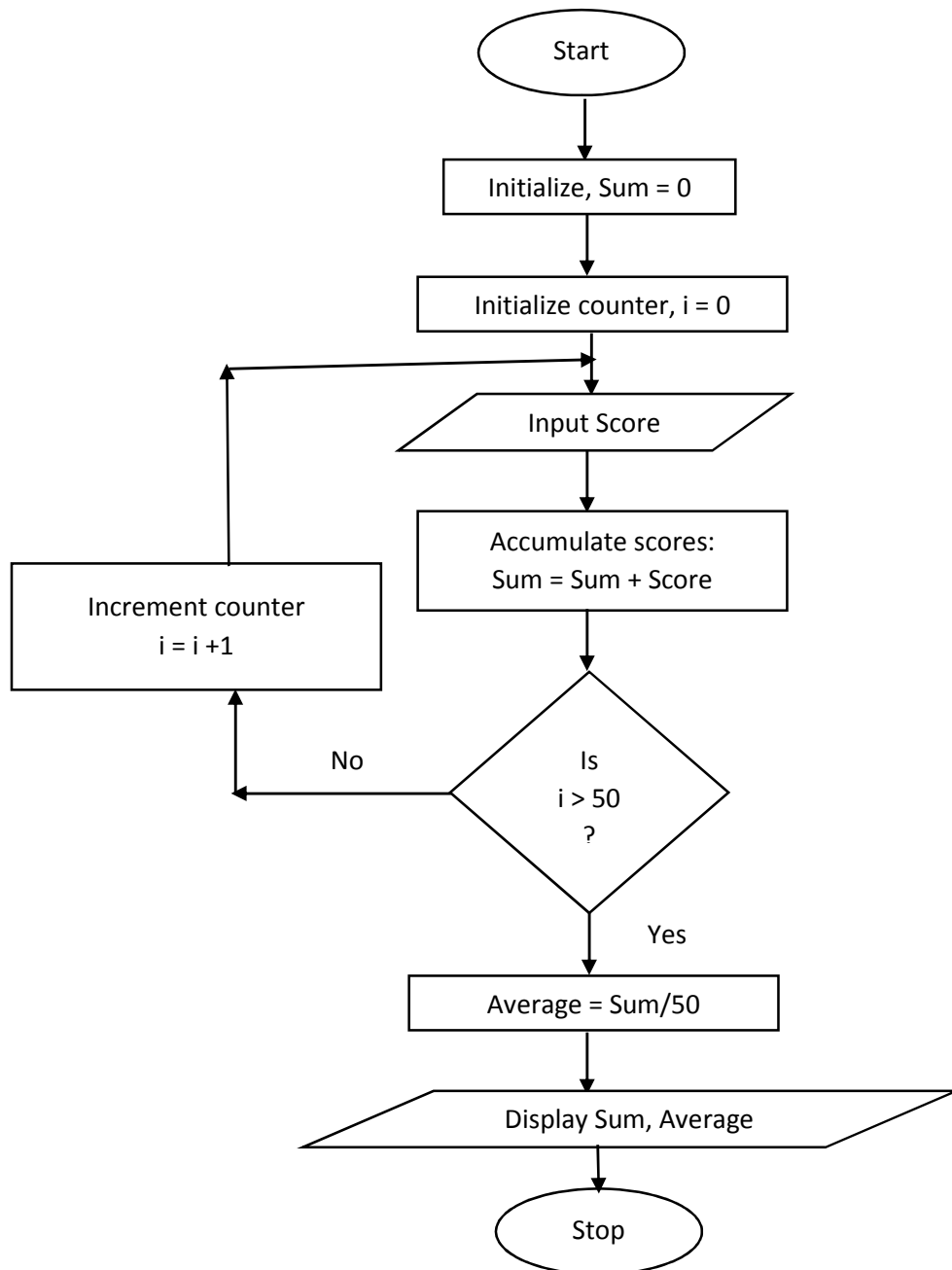


Figure 1.2 : Flowchart to compute the average score of 50 students

1.3 Computer Programming using MATLAB (Lecture 3)

This part will focus on the use of MATLAB as a programming tool. We shall first of all do a brief introduction to MATLAB before taking a tour around its environment.

1.3.1 MATLAB Environment

Six major areas were identified in the graphical window. These areas are

1. Tool Strip or Banner
2. Command Window
3. Current Folder
4. Command History
5. Work Space
6. Status Bar

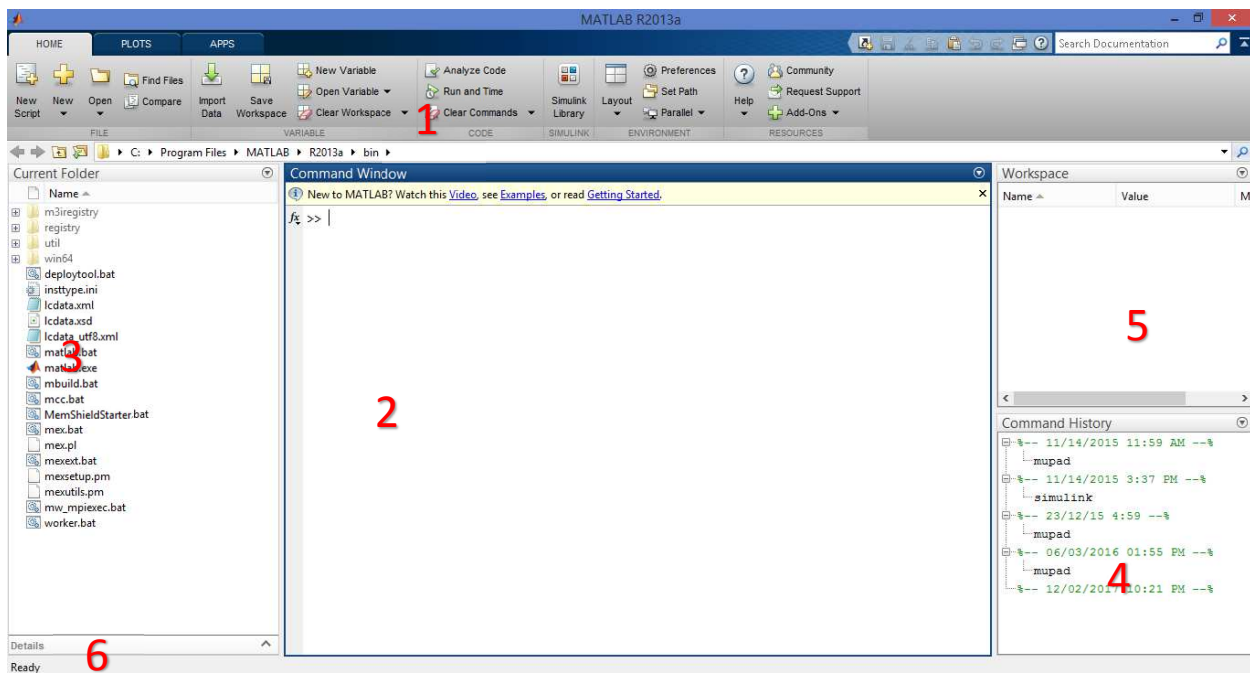



Figure 3.1 The graphical screen of MATLAB

1.3.1.6 Create a Working Folder

The easiest way to create working folder in MATLAB is to



1. Click on the browse for folder icon () at the top of the current folder window
2. Browse to locate the folder you want to use or click New Folder to create a new folder
3. Click select button to select the folder.

With this step, you have created your own folder and you can see it as the current folder. Everything you do now will be saved in that folder.

1.3.2 Basic Commands in MATLAB

Now that we are familiar with the graphical window of MATLAB, we shall now begin to learn how to work with the various areas of the window. Before we start using MATLAB commands, we shall first learn some basic concepts that will help us with that.

Variables

Variables are reserved memory locations for storing data. Variables have the following attributes:

1. Variable name are case sensitive
2. Data Types are dynamic.
3. Variable names must not be any built-in function or keyword (use which and iskeyword commands to find unique variable names)
4. Variables can be vector, arrays or matrices

Creating Variables and Assigning Values to Variables

```
Command Window
>> x = 6
x =
    6
fx >>
```

In the command window shown x was created as variable and 6 was assign to it at the same time.

If you type for instance

X+4

MATLAB will output 10.

This means that the initial value of x has been added to 4 to produce the output. The value stored in the variable will remain until a new value is assigned.

MATLAB command window can be used as a calculator. In such case, brackets must be used to control the precedence order to ensure that the correct result is obtained. This details will be covered during practical class. The table below shows some operators we shall be using in the future.

1.4 Summary

In this module, we have been able to show how to use pseudo-code and flowchart in program design and development. It was clear that these design tools are very useful in the analysis and design of programs. Some handy examples have also been presented.

The second part of this module presented the introductory concept of MATLAB. The environment of MATLAB was presented, showing how to enter commands at the command window.



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