

# 20CYS312 - Principles of Programming Languages

## Exploring Programming Paradigms

### Assignment-01

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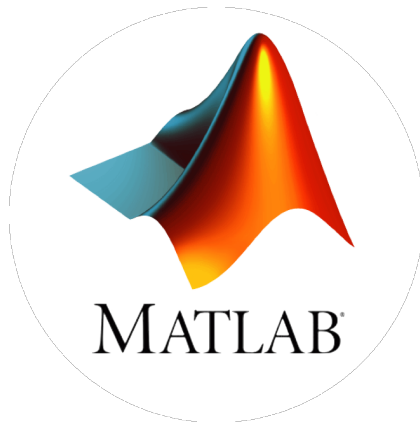
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# Imperative Programming

- Imperative programming modifies the state of a program through statements that explicitly change variables or memory locations.
- Functions in imperative programming are coded step-by-step to solve a problem, specifying the exact sequence of operations.
- Imperative programming uses control flow commands like loops and conditionals to direct the execution flow, telling the computer "how" to perform tasks.





**Figure:** MATLAB (Imperative Paradigm)



- MATLAB ("MATrix LABoratory") is a proprietary multi-paradigm programming language and numeric computing environment developed by MathWorks.
- is designed for high-performance technical computing, providing an integrated environment for computation, visualization, and programming.
- Also it uses arrays as its basic data element, allowing users to express problems and solutions in familiar mathematical notation. It excels in solving matrix and vector-based problems interactively, offering efficiency compared to scalar non interactive languages like C or FORTRAN.

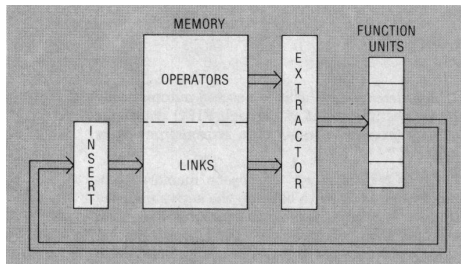


- **Matrix/Array Operations** - MATLAB excels in matrix and array operations, providing a powerful language for numerical computations.
- **User-Friendly Environment** - It offers a user-friendly working environment with tools for data management, debugging, and profiling, suitable for both small-scale scripting and large-scale application development.
- **Graphics and Visualization** - The Handle Graphics system supports high-level commands for easy data visualization and low-level commands for customization, including the creation of GUIs.
- **Comprehensive Mathematical Library** - MATLAB includes a vast mathematical function library, covering a wide range of computational algorithms from elementary functions to advanced operations like matrix inverse, eigenvalues, and Fourier transforms.



# Dataflow Programming

- In computer programming, dataflow programming is a programming paradigm that models a program as a directed graph of the data flowing between operations, thus implementing dataflow principles and architecture.
- Each operation may be represented as a node in a graph. Nodes are connected by directed arcs through which data flows.
- A node performs its operation when its input data are available. It sends out the result on the output arcs.





**Figure:** LabVIEW (Dataflow Paradigm)





# About LabVIEW

- LabVIEW is a graphical programming language used for data acquisition, instrument control, and industrial automation.
- Programs in LabVIEW are called virtual instruments (VIs) and are represented as block diagrams where nodes represent various functions and operations. Each VI consists of interconnected nodes, and the wires represent the flow of data between nodes.
- It follows a dataflow programming paradigm, where the flow of data determines the execution order of operations.
- It is widely used in fields such as engineering, physics, and automation due to its intuitive visual programming approach.



# Functions of LabVIEW

- **Data Acquisition (DAQ)** - LabVIEW is extensively used for acquiring data from various sensors and instruments. Its graphical programming approach simplifies the integration of data acquisition hardware.
- **Instrument Control** - It allows users to interface with and control a wide range of instruments, making it suitable for applications in research, testing, and automation.
- **Signal Processing** - With built-in libraries and functions, LabVIEW supports signal processing tasks, making it valuable in applications such as audio processing, image processing, and more.
- **Industrial Automation** - LabVIEW finds applications in industries for automating processes, monitoring equipment, and controlling systems. Its versatility makes it a popular choice in manufacturing environments.



# Comparison and Discussions

- **Programming Paradigm** - LabVIEW is known for its graphical dataflow programming paradigm, while MATLAB uses a text-based imperative and array-based paradigm.
- **Applications** - LabVIEW is widely used in applications involving hardware interfacing and real-time control, while MATLAB is commonly employed for numerical analysis, mathematical modeling, and algorithm development.
- **User Interface** - LabVIEW is recognized for its graphical user interface (GUI) development capabilities, particularly in creating custom interfaces for hardware control. MATLAB also supports GUI development but is more commonly used for algorithm development in a scripting environment.
- **Hardware Integration** - LabVIEW excels in integrating with various hardware devices, making it a preferred choice for applications involving real-time data acquisition and control. MATLAB has good hardware support but is often used more for simulation and algorithm development.



- [https://en.wikipedia.org/wiki/Imperative\\_programming](https://en.wikipedia.org/wiki/Imperative_programming)
- <https://devopedia.org/dataflow-programming>
- <https://cimss.ssec.wisc.edu/wxwise/class/aos340/spr00/whatismatlab.htm>
- <https://en.wikipedia.org/wiki/MATLAB>
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- "LabVIEW for Everyone" by Jeffrey Travis and Jim Kring

