Advanced Programming Practice

Course Code:21CSC203P

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UNIT-1

Content

- Introduction
- Elements of Programming Languages
- Programming Language Theory
- Bohm-Jacopini Structured Program Theorem
- Programming Paradigm Hierarchy
- Multiple Programming Paradigms
- Subroutine
- Dynamic Memory Allocation
- Dynamically Dispatched Message Calls
- Object Serialization
- Parallel Computing

Course Learning Outcome:

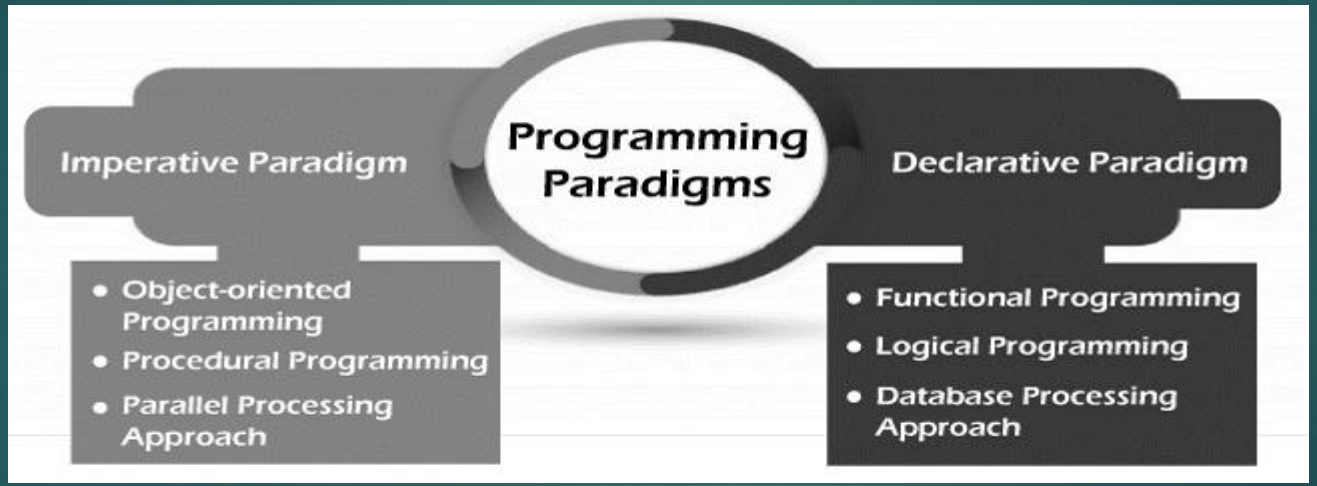
- Understand the concept of Programming
- Understand the paradigm functionalities and their hierarchy
- Devise solutions using various programming paradigm
- Express proficiency in the usage of structural, procedural, and Object-Oriented Programming Paradigm
- Understand the concept of Dynamic memory

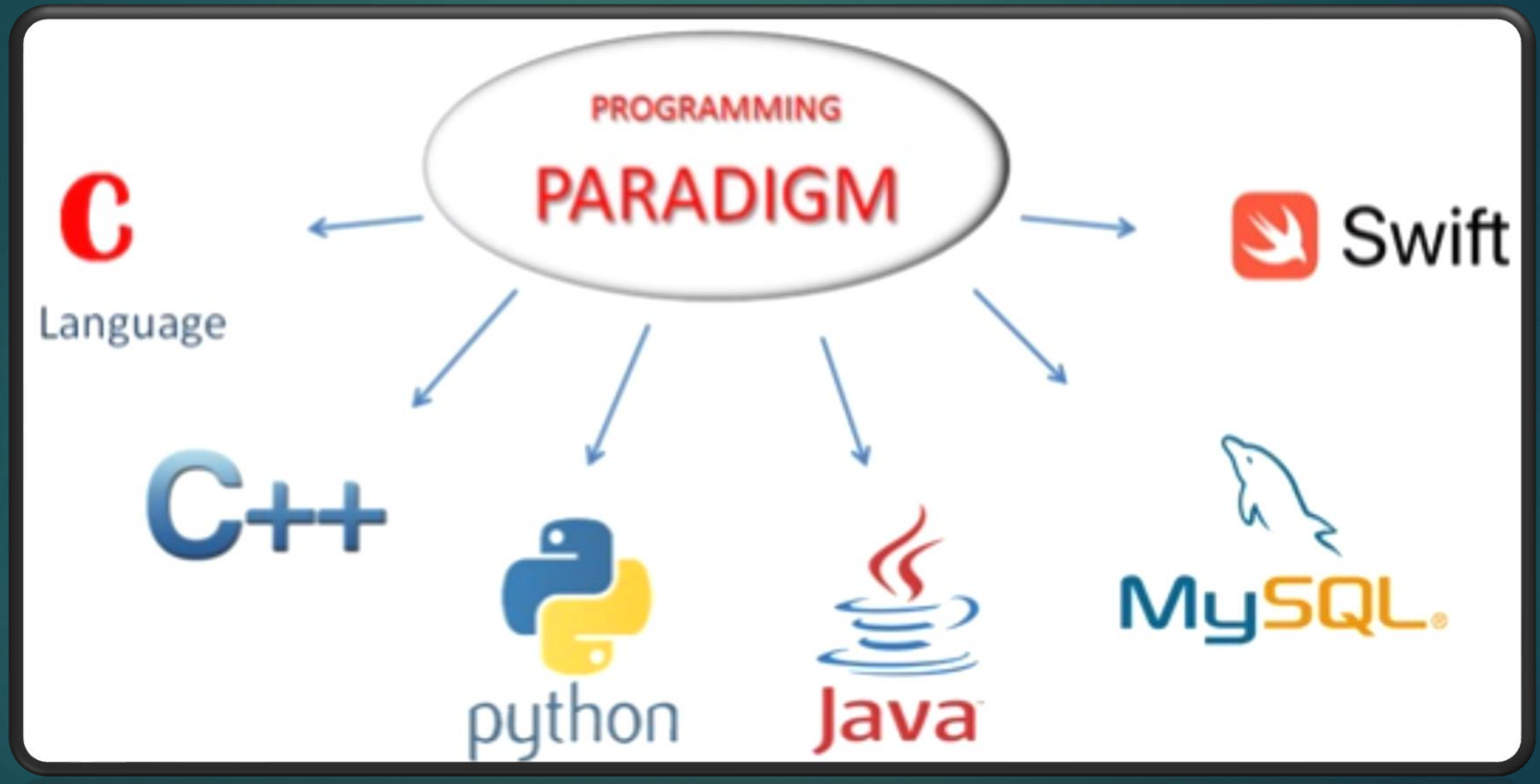
INTRODUCTION TO PROGRAMMING PARADIGM

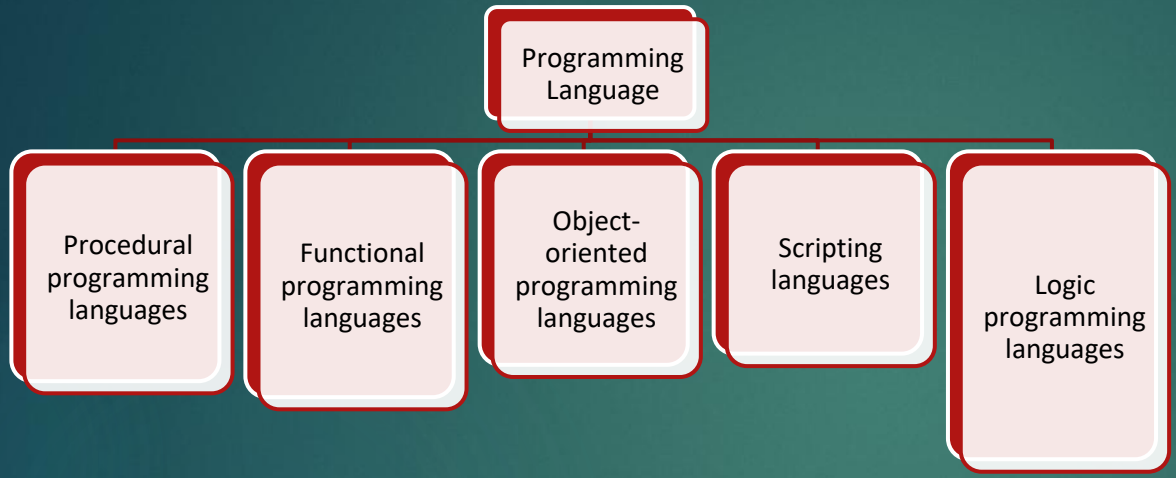
- A programming paradigm is a way of classifying and organizing programming languages
- Paradigm can also be termed as method to solve some problem or do some task
- Each programming paradigm has its own set of concepts, rules, and techniques that guide the development process

Programming Paradigm

- A programming paradigm is a fundamental approach or style of programming that guides the process of designing, structuring, and implementing computer programs.




PROGRAMMING
PARADIGM
C
Language
Swift
C++
python
Java
MySQL



1. Procedural programming languages
- C and C++
- Java
- Pascal
- BASIC

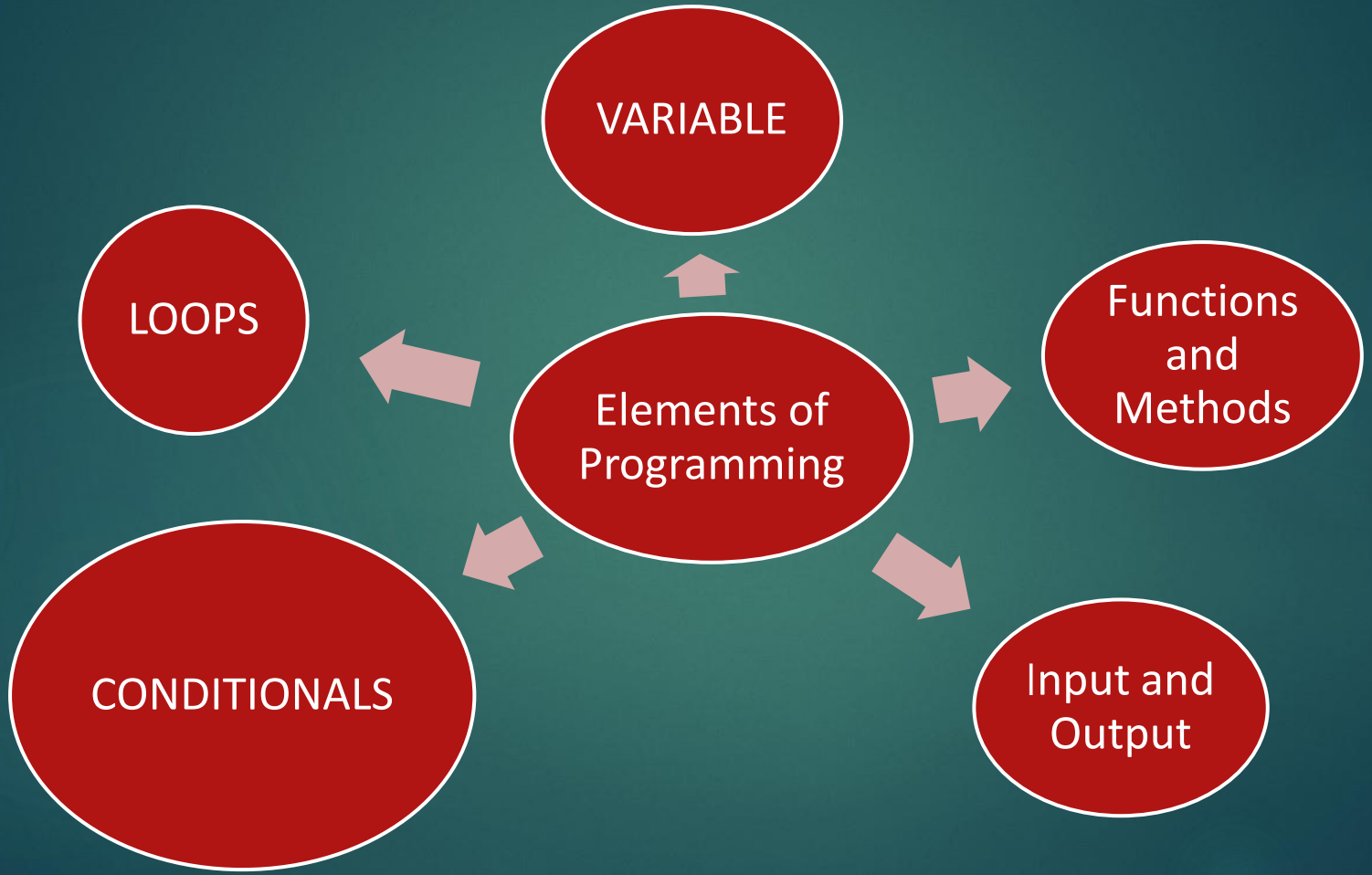
2.Functional programming languages
- Scala
- Erlang
- Haskell
- Elixir
- F#

3.Object-oriented programming languages
- Java
- Python
- PHP
- C++
- Ruby

4.Scripting languages
- PHP
- Ruby
- Python
- bash
- Perl
- Node.js

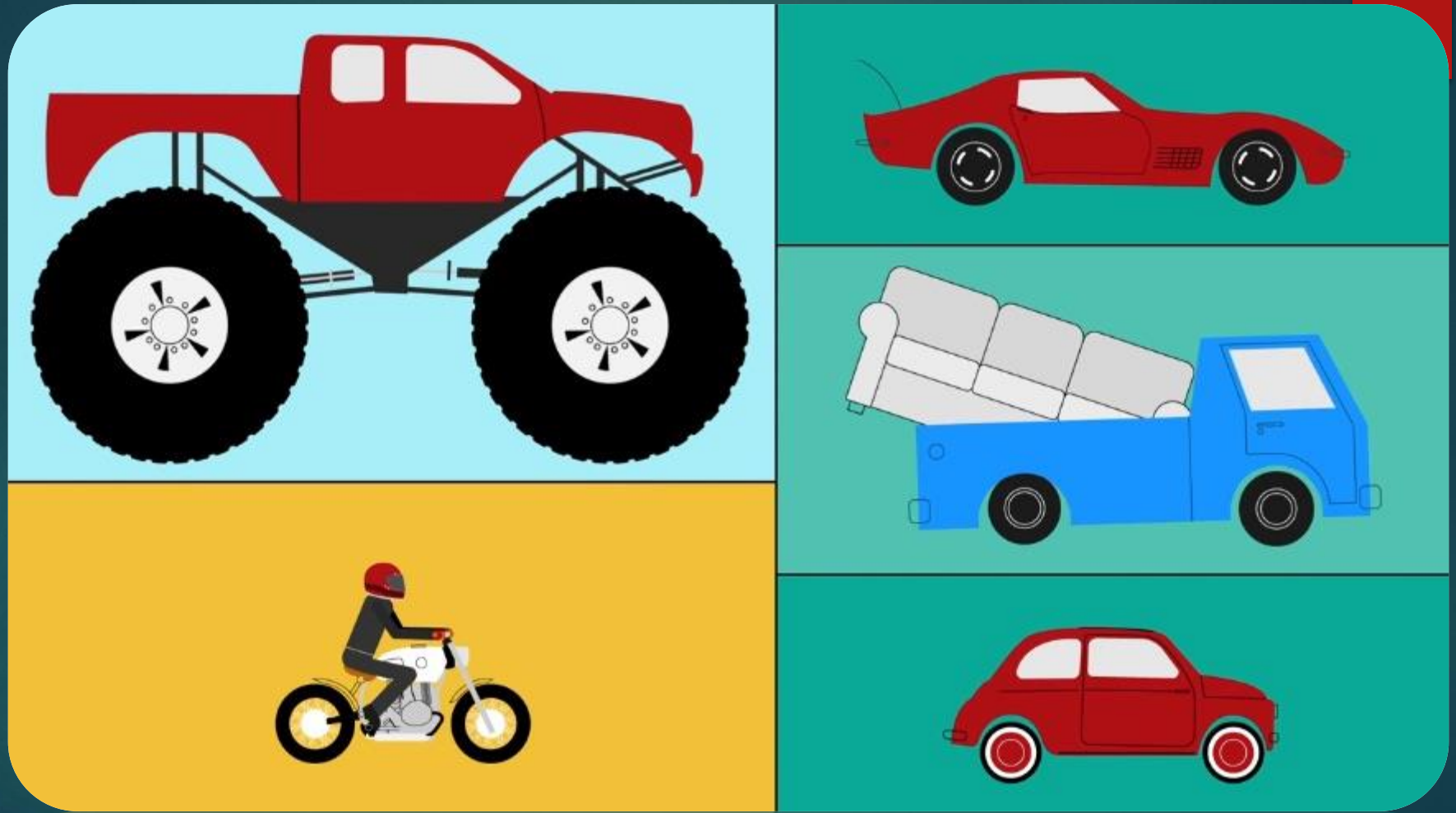
5.Logic programming languages
- Prolog
- Absys
- Datalog
- Alma-0

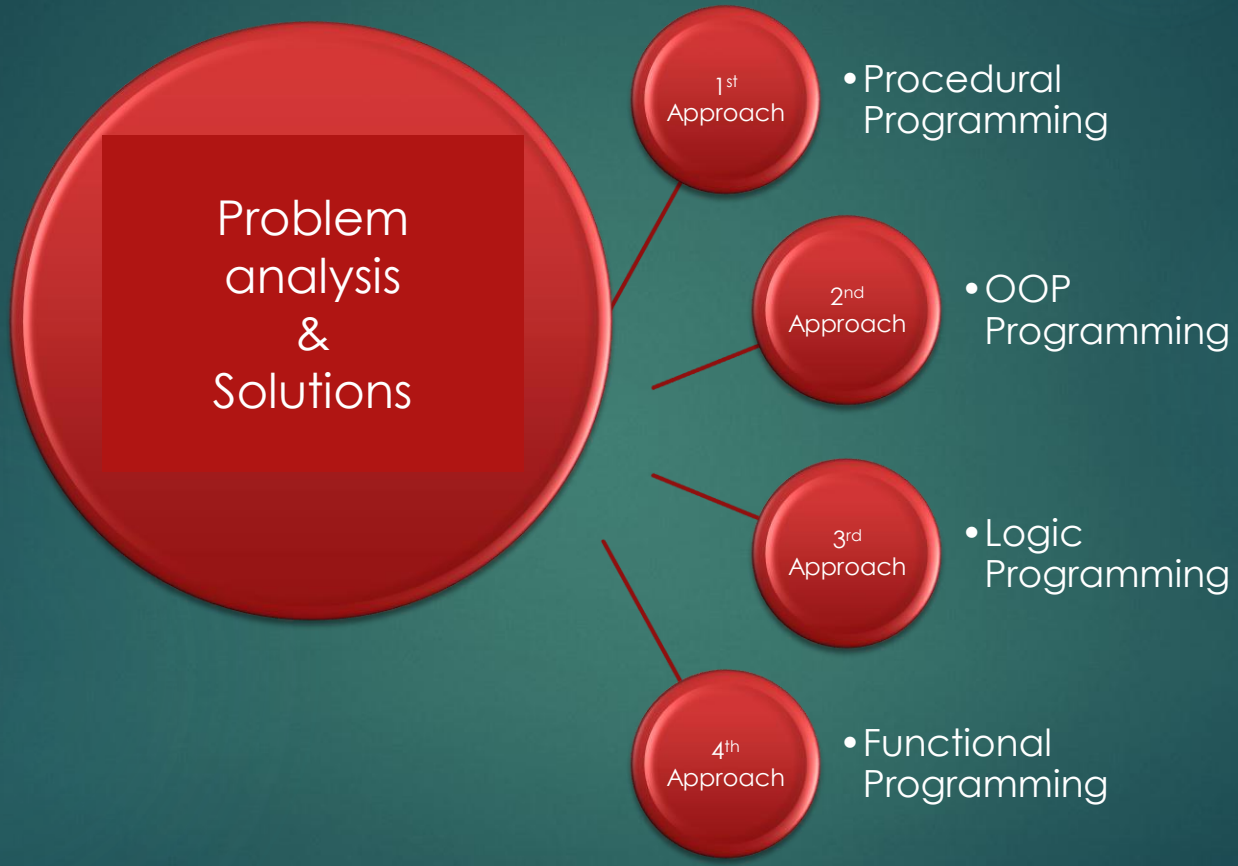
Elements Of Programming



Programming

- A programming language is made up of specific terms and directions that are used to create some type of output, such as websites, apps, and other software.
- Languages like JavaScript(Script Language), Python, and Java are often used by websites for a variety of purposes. C++ is used just about everywhere to make things like desktop apps, games, and more.



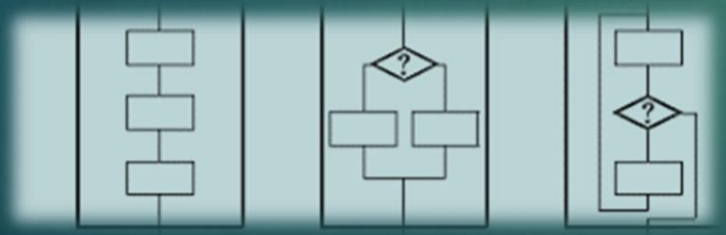


Programming paradigm is all about different approaches used to find a software solution to the problem.

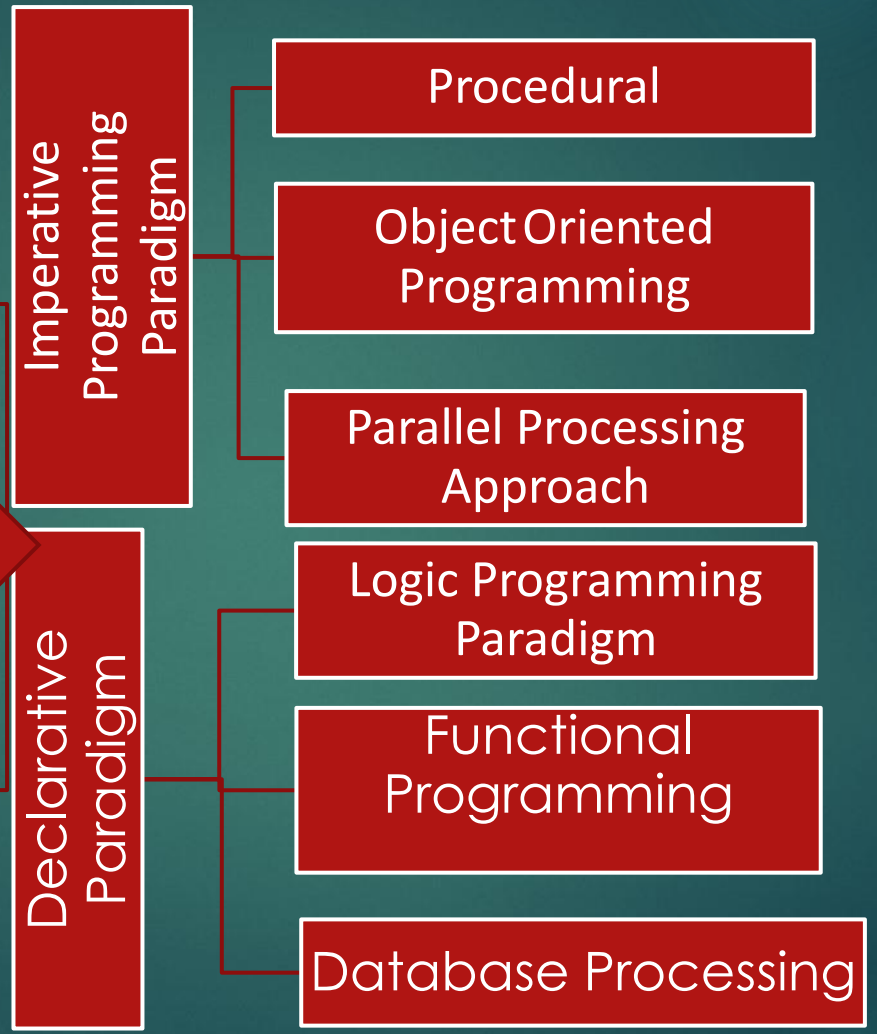
Böhm-Jacopini theorem

The theorem was formulated independently by Corrado Böhm and Giuseppe Jacopini in the 1960s. According to Böhm-Jacopini theorem, an algorithm can be written using only three statements:

- Sequence: Executing one subprogram & other subprogram
- Selection: Execute one of two subprogram according to the value of a Boolean expression also called decision
- Iteration: Executing a Subprogram until a Boolean expression is true.



Programming Paradigm Hierarchy



Imperative vs Declarative

- Imperative :
  - Focus on how to execute, defines control flow as statements that change a program state.
- Declarative:
  - Focus on what to execute defines program logic ,but not detailed control flow.

Imperative programming paradigm

- Imperative programming is a programming paradigm that focuses on describing a sequence of steps or instructions to solve a problem.
- They are first executed, and then the results are stored in a variable. It is more of a line-by-line instruction given to the computer.
- Common examples of imperative programming languages include C, Java, Python, and JavaScript. These languages provide constructs and syntax specifically designed for imperative programming, making it easier to write programs that follow this paradigm

Advantages:
Very simple to implement It contains loops, variables etc.

Disadvantage:
Complex problem cannot be solved Less efficient and less productive Parallel programming is not possible

Procedural programming paradigm –

- Procedural programming is a programming paradigm that focuses on the concept of procedures or routines, which are a sequence of instructions that perform specific tasks. It emphasizes dividing a program into smaller, reusable procedures and organizing them in a hierarchical manner to solve a problem.

Some of the languages that use procedural programming paradigms are:

- C
- C++
- Java
- Python
- Pascal

There is no difference in between procedural and imperative approach. It has the ability to reuse the code and it was boon at that time when it was in use because of its reusability.

Object oriented programming –

- The program is written as a collection of classes and object which are meant for communication. In OOP, programs are structured around the concepts of inheritance, encapsulation, and polymorphism.

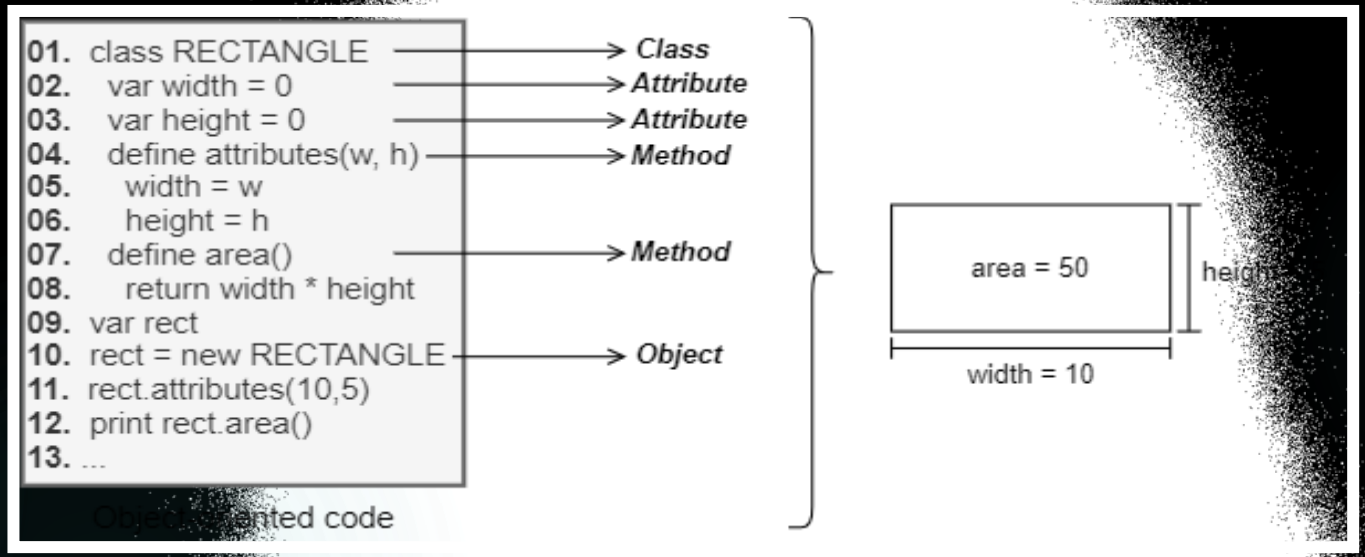
Some of the languages that use object-oriented programming paradigms are:

- Python
- Ruby
- Java
- C++
- Smalltalk

OOPs Concepts:

- Class
- Objects
- Inheritance
- Polymorphism
- Data Abstraction
- Encapsulation

Structure of Object-Oriented Programming


01. class RECTANGLE
02. var width = 0
03. var height = 0
04. define attributes(w, h)
05. width = w
06. height = h
07. define area()
08. return width * height
09. var rect
10. rect = new RECTANGLE
11. rect.attributes(10,5)
12. print rect.area()
13. ...
Class
Attribute
Attribute
Method
Method
Object
area = 50
width = 10

Parallel processing approach –

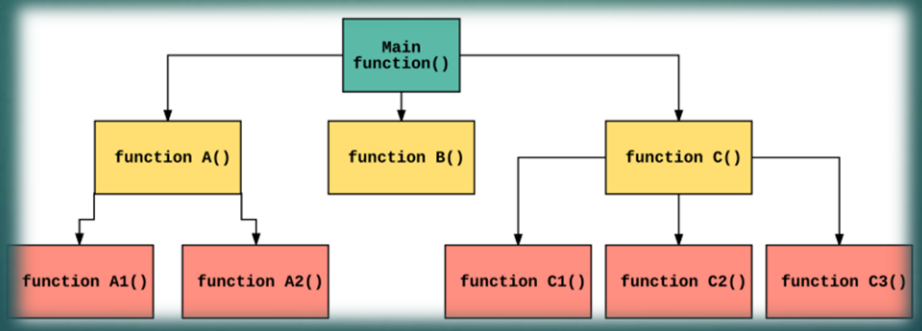
- Parallel processing is the processing of program instructions by dividing them among multiple processors.
- A parallel processing system posses many numbers of processor with the objective of running a program in less time by dividing them. This approach seems to be like divide and conquer. Examples are NESL (one of the oldest one) and C/C++ also supports because of some library function.

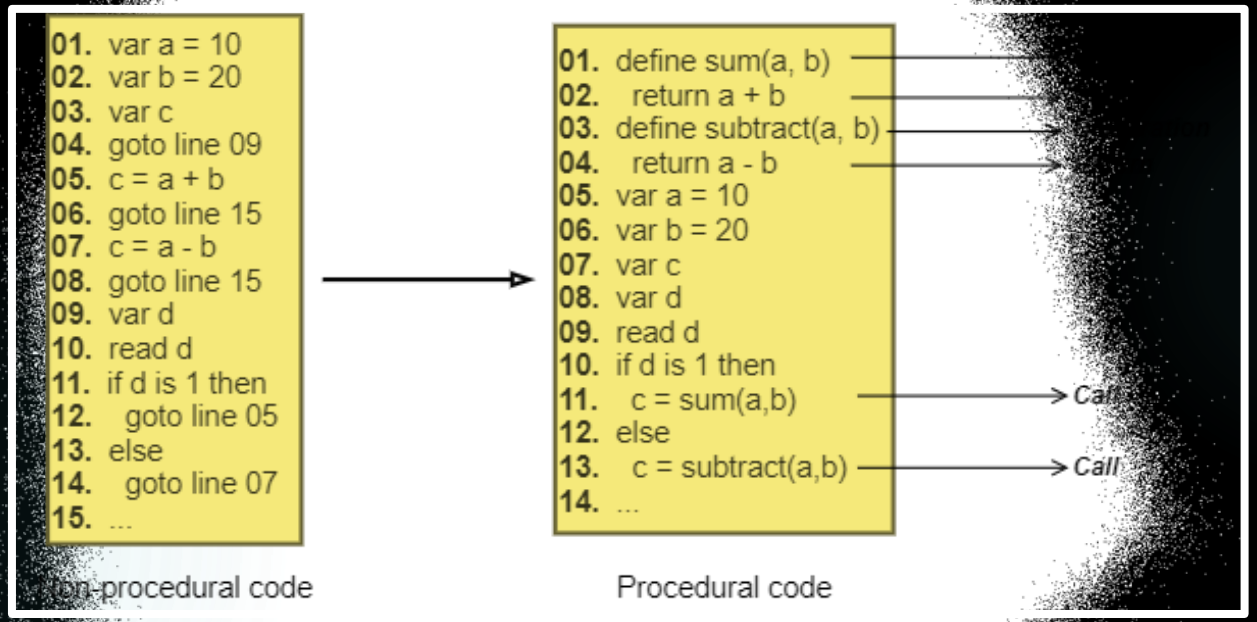
Declarative programming paradigm:

- Declarative programming is a programming paradigm that focuses on describing the logic and properties of a computation without explicitly specifying the control flow
- The main focus of the declarative style of programming is achieving the end result .This paradigm is straight forward and to the point while writing the program code.
- It is divided as Logic, Functional, Database

Functional Programming

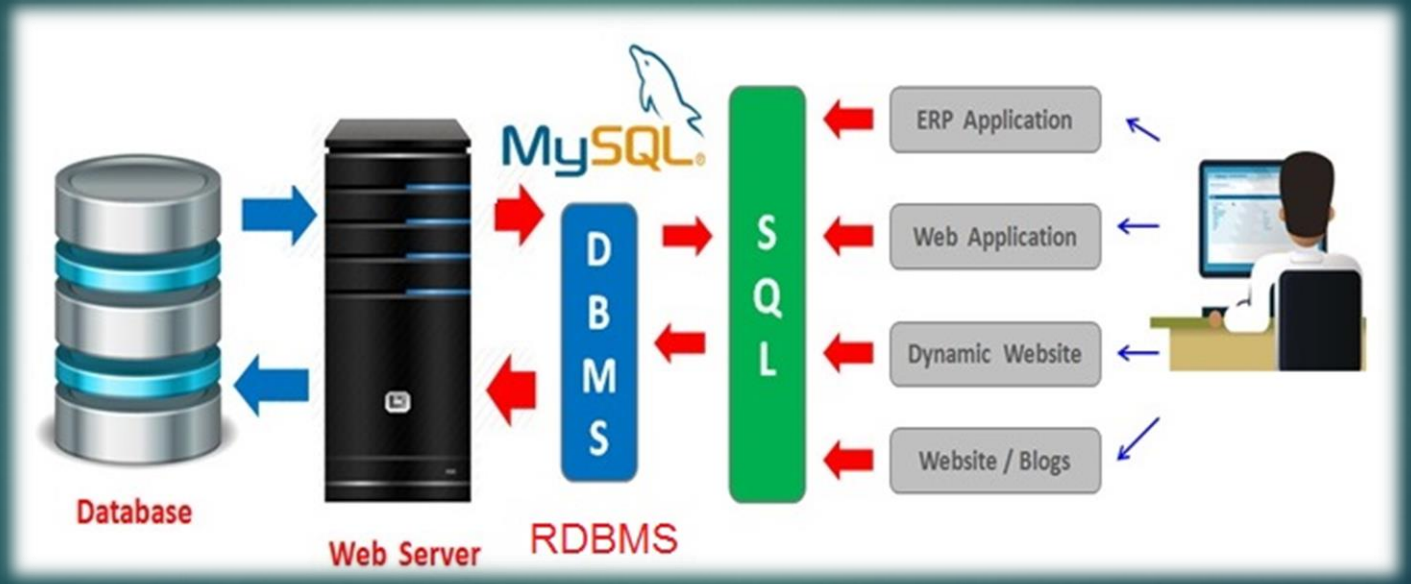
- It is a subset of declarative programming. Programs that are written using the paradigm use functions, blocks of codes, intended to behave like mathematical functions. It discourages changes in the value of variables through the assignment. Instead makes a great deal with recursion.




01. var a = 10
02. var b = 20
03. var c
04. goto line 09
05. c = a + b
06. goto line 15
07. c = a - b
08. goto line 15
09. var d
10. read d
11. if d is 1 then
12. goto line 05
13. else
14. goto line 07
15. ...
Non-procedural code
01. define sum(a, b)
02. return a + b
03. define subtract(a, b)
04. return a - b
05. var a = 10
06. var b = 20
07. var c
08. var d
09. read d
10. if d is 1 then
11. c = sum(a,b)
12. else
13. c = subtract(a,b)
14. ...
Call
Call
Procedural code

Database Paradigm–

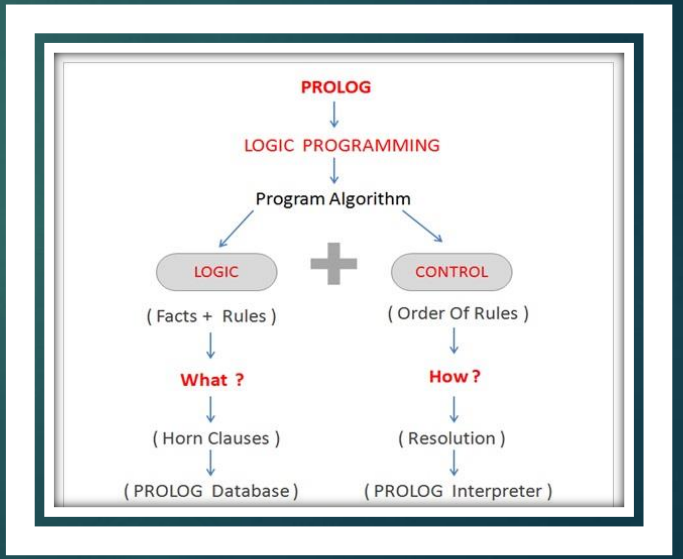
The database query language such SQL (Structured Query Language) is the most commonly used example of model based language.



Logic Programming

The logic programming is a declarative programming paradigm that is based on the logic and the control . The term logic essentially means facts and rules . Whereas the control means an order of rules.

A logic program is a collection of logical propositions and questions and use the concepts of AI, machine learning models



If x is bird or an airplane, then x has wings
Tweedy is a bird.
Does tweedy have wings?
Use the concepts of AI, machine learning models

Multi-PARADIGM

A multi-paradigm programming language is a programming languages that supports more than one programming paradigm.

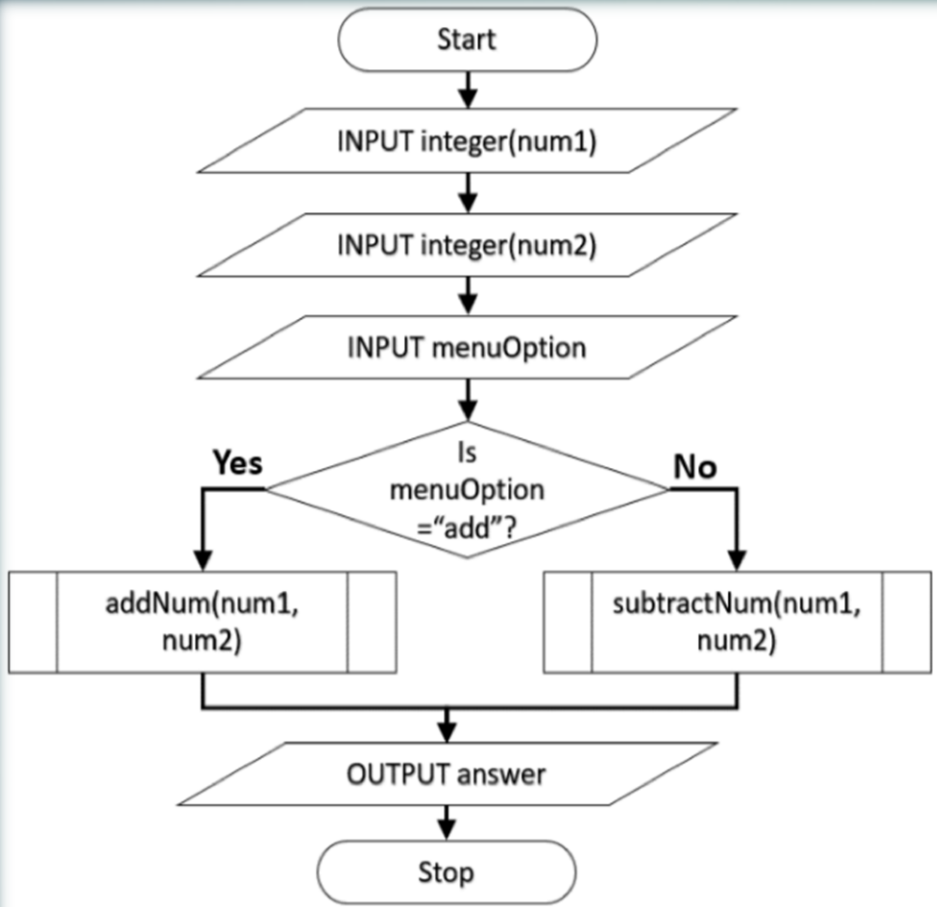
Some programming languages that clearly belong to a specific paradigm . However , there are programming languages that do not fall under a one specific paradigm. Such languages might allow the program code that implements more than one paradigm.

Such programming languages are referred to as multi-paradigm programming languages

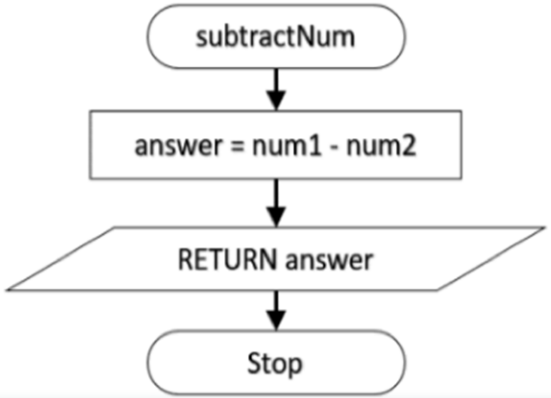
JAVA
PYTHON

Subroutines

- Small program written & stored separately .It can be called whenever required.
- In computer programming, a subroutine is a sequence of program instructions
- That performs a specific task, packaged as a unit.
- In different programming languages, a subroutine may be called a procedure, a function, a routine, a method, or a subprogram.


Start
INPUT integer(num1)
INPUT integer(num2)
INPUT menuOption
Is menuOption ="add"?
Yes
No
addNum(num1, num2)
subtractNum(num1, num2)
OUTPUT answer
Stop


addNum
answer = num1 + num2
RETURN answer
Stop


subtractNum
answer = num1 - num2
RETURN answer
Stop

Memory Allocation

Memory allocation is the process of allocating or assigning memory.

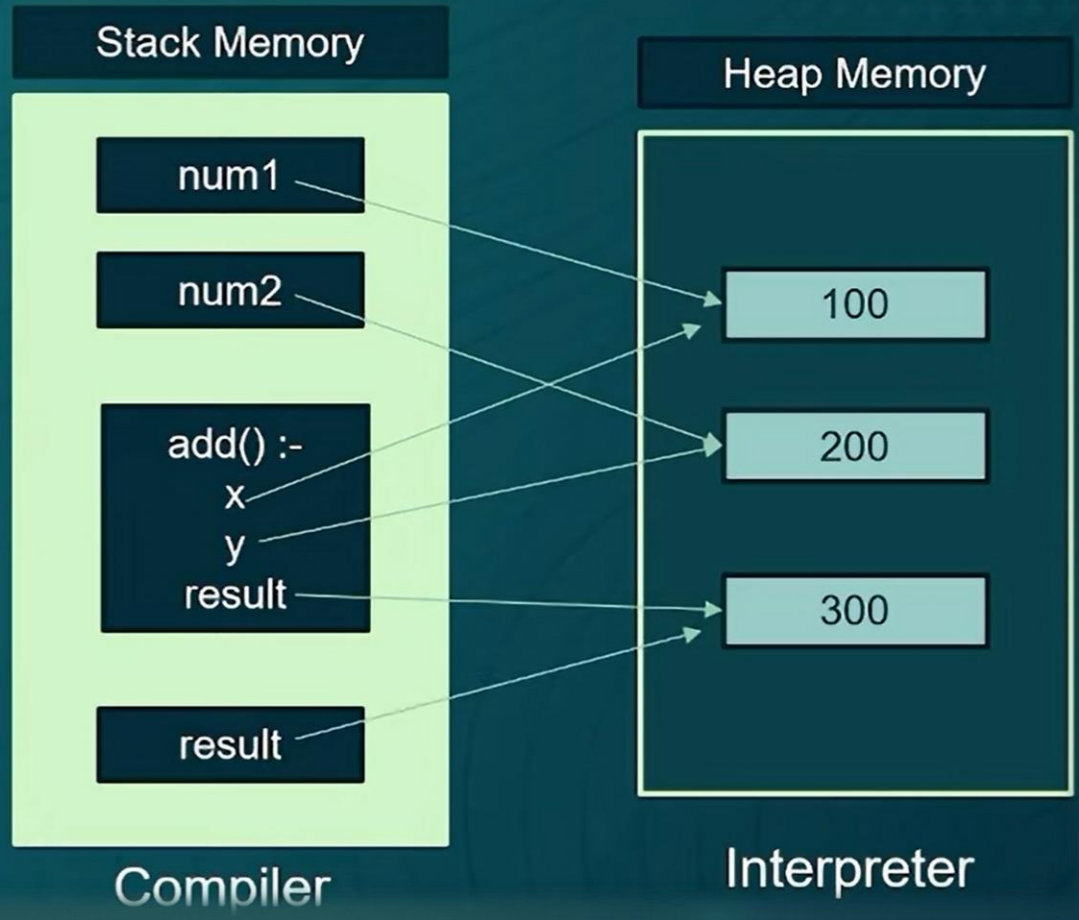
There are 2 types of Memory Allocations

- Static memory allocation is the process of assigning the memory space during the compile time.
- Dynamic memory allocation is the process of assigning the memory space during the execution time or the run time

Memory Allocation :-

```
num1 = 100
num2 = 200
def add(x,y):
        result = x+y
        return result
```

Result=add(num1,num2)

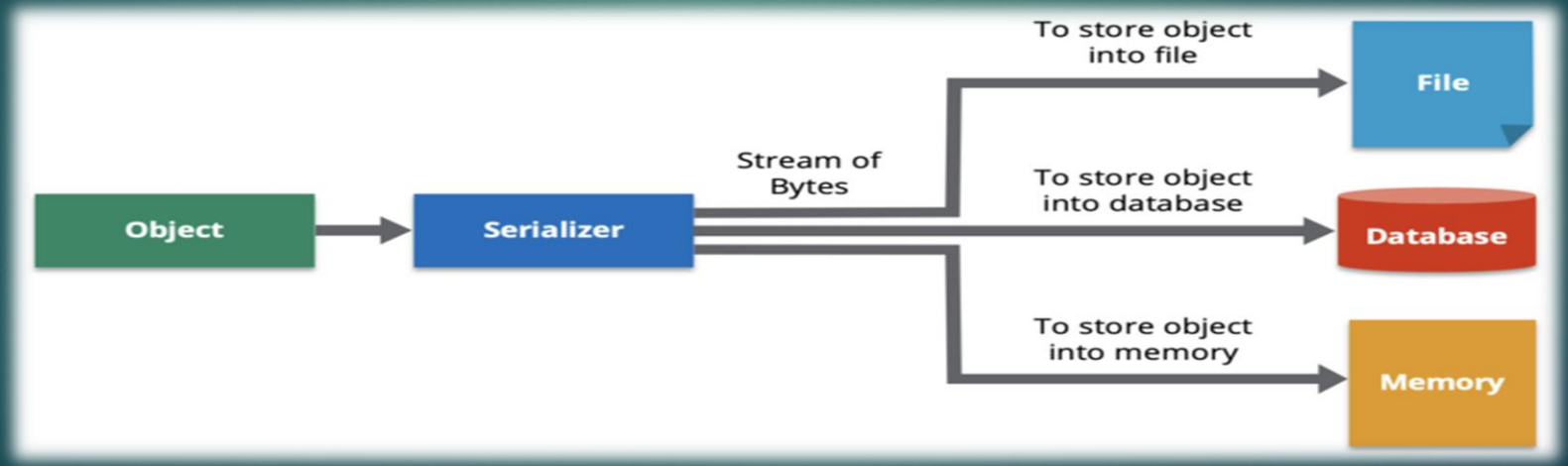


Dynamically dispatched message calls

- Dynamic method dispatch is the mechanism by which a call to an overridden method is resolved at run time, rather than compile time.
- In this process, an overridden method is called through the reference variable of a superclass.
- The determination of the method to be called is based on the object being referred to by the reference variable.

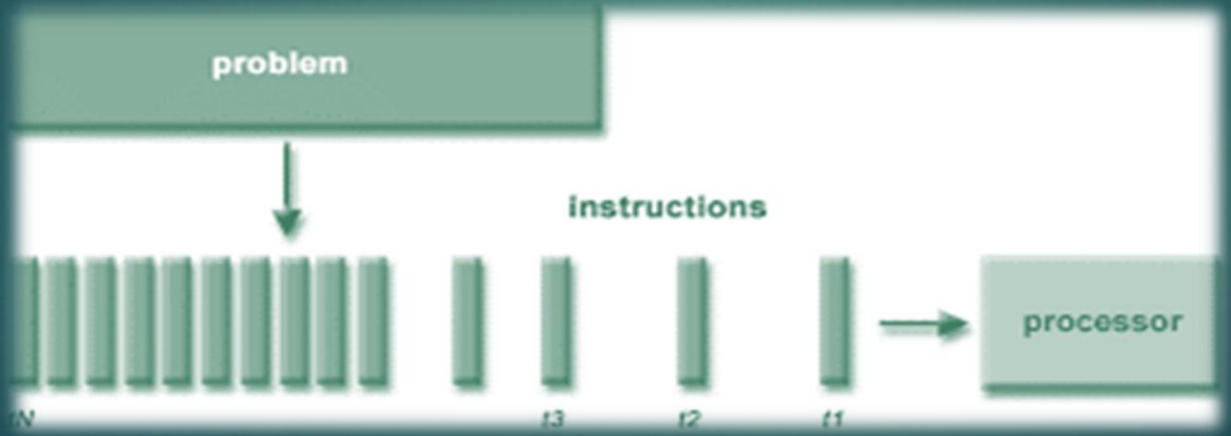
Object Serialization

- Serialization is the process of converting a data object—a combination of code and data represented within a region of data storage—into a series of bytes that saves the state of the object in an easily transmittable form.



Parallel Computing

- ✓ The fundamental idea of parallel computing is rooted in doing multiple tasks at the same time to reduce the running time of your program.
- ✓ Parallel computing also helps in faster application processing and task resolution by increasing the available computation power of systems



THANK YOU