

# HSC SECOND YEAR – COMPUTER SCIENCE

## CHAPTER 3: Scoping

Prepared by,

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# Learning Objectives

The student will be able to,

- Understand what is Scoping
- Able to implement the LEGB rule
- Understand what is module
- Understand the implementation of access control in programming language

## Introduction - Variable Scope

- **Scope** refers to the accessibility of a variable within one part of a program to another part of the same program.
- To understand the scope of variables in a programming language, it is important to learn about what variables really are.
- Essentially, they're addresses to an object in memory. When you assign a variable with `:=` to an instance (object), you're binding (or mapping) the variable to that instance.

# Variable Scope

- *The process of binding a variable name with an object is called **mapping**. = (equal to sign) is used in programming languages to map the variable and object.*
- ***Namespaces** are containers for mapping names of variables to objects.*

## LEGB rule

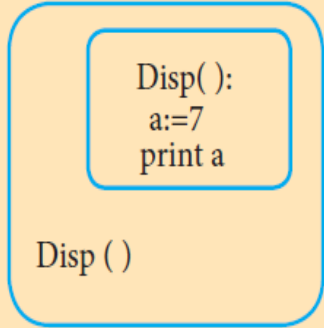
- The *LEGB rule* is used to decide the order in which the scopes are to be searched for scope resolution.
- The scopes are listed below in terms of hierarchy

<i>Scope</i>	<b>Explanation</b>
Local( <b>L</b> )	Defined inside function/class
Enclosed( <b>E</b> )	Defined inside enclosing functions (Nested function concept)
Global( <b>G</b> )	Defined at the uppermost level
Built-in ( <b>B</b> )	Reserved names in built-in functions (modules)

# Types of Variable Scope

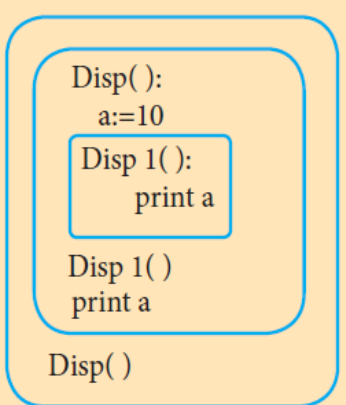
## Local Scope:

- Local scope refers to variables defined in current function.
- Always, a function will first look up for a variable name in its local scope. Only if it does not find it there, the outer scopes are checked.

	Entire program	Output of the Program
1. Disp():		
2. a:=7		
3. print a		
4. Disp()		7

# Enclosed Scope

- A variable which is declared inside a function which contains another function definition with in it, the inner function can also access the variable of the outer function. This scope is called enclosed scope.*

	Entire program	Output of the Program
1. Disp():		
2. a:=10		10
3. Disp1():		10
4. print a		
5. Disp1()		
6. print a		
7. Disp()		

# Global Scope

- A variable which is declared outside of all the functions in a program is known as global variable. This means, global variable can be accessed inside or outside of all the functions in a program.

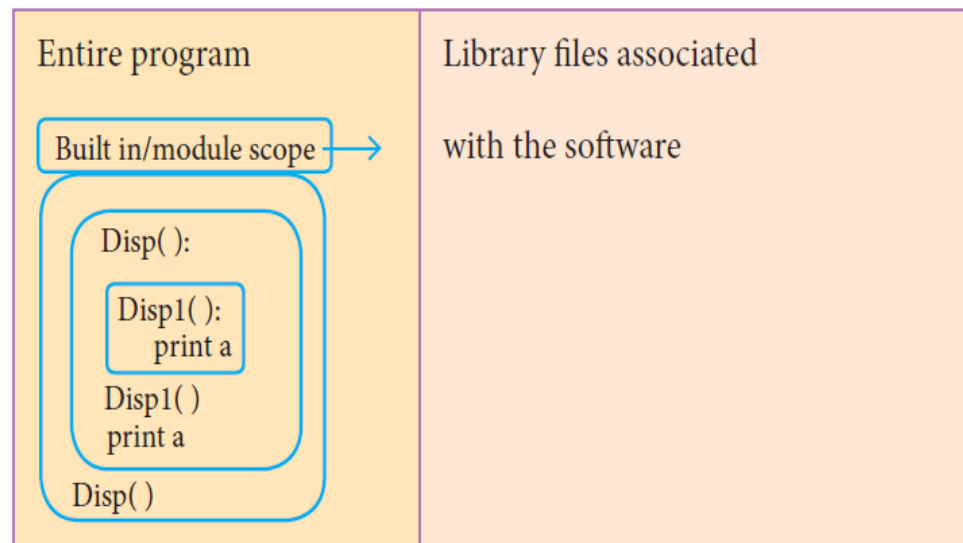
Consider the following example,

	Entire program	Output of the Program
1. a:=10	<pre>graph TD     subgraph Entire_program [Entire program]         A[a:=10]         subgraph Disp_box [Disp()]             B[a:=7]             C[print a]         end         D[Disp(): print a]     end</pre>	
2. Disp():		7
3. a:=7		10
4. print a		
5. Disp()		
6. print a		



## Built-in Scope

- The built-in scope has all the names that are pre-loaded into the program scope when we start the compiler or interpreter.
- Any variable or function which is defined in the modules of a programming language has Built-in or module scope.



# Module

- A module is a part of a program.
- Programs are composed of one or more independently developed modules.
- A single module can contain one or several statements closely related each other.
- A program can be divided into small functional modules that work together to get the output. The process of subdividing a computer program into separate sub-programs is called Modular programming.
- The examples of modules are procedures, subroutines, and functions.

# Characteristics of Modules

- Modules contain instructions, processing logic, and data.
- Modules can be separately compiled and stored in a library.
- Modules can be included in a program.
- Module segments can be used by invoking a name and some parameters.
- Module segments can be used by other modules.

# The benefits of using modular programming

- **Less code to be written.**
- **A single procedure can be developed for reuse, eliminating the need to retype the code many times.**
- **Programs can be designed more easily because a small team deals with only a small part of the entire code.**
- **Modular programming allows many programmers to collaborate on the same application.**
- **The code is stored across multiple files.**
- **Code is short, simple and easy to understand.**
- **Errors can easily be identified, as they are localized to a subroutine or function.**
- **The same code can be used in many applications.**
- **The scoping of variables can easily be controlled.**

# Access Control

- Access control is a security technique that regulates who or what can view or use resources in a computing environment.
- It is a fundamental concept in security that minimizes risk to the object.
- In other words access control is a selective restriction of access to data.
- Classical object-oriented languages, such as C++ and Java, control the access to class members by public, private and protected keywords.

# Access Control

- **Private members** of a class are denied access from the outside the class. They can be handled only from within the class.
- **Public members** (generally methods declared in a class) are accessible from outside the class. The object of the same class is required to invoke a public method.
- **Protected members** of a class are accessible from within the class and are also available to its subclasses.
- All members in a Python class are public by default, whereas by default in C++ and java they are private.

# EVALUATION

1. Which of the following refers to the visibility of variables in one part of a program to another part of the same program.  
(A) Scope (B) Memory (C) Address (D) Accessibility
2. The process of binding a variable name with an object is called  
(A) Scope (B) Mapping (C) late binding (D) early binding
3. Which of the following is used in programming languages to map the variable and object?  
(A):: (B) := (C) = (D) ==
4. Containers for mapping names of variables to objects is called  
(A) Scope (B) Mapping (C) Binding (D) Namespaces

# EVALUATION

5. Which scope refers to variables defined in current function?
- (A) Local Scope (B) Global scope  
(C) Module scope (D) Function Scope
6. The process of subdividing a computer program into separate sub-programs is called
- (A) Procedural Programming  
(B) Modular programming  
(C) Event Driven Programming  
(D) Object oriented Programming
7. Which of the following security technique that regulates who can use resources in a computing environment?
- (A) Password (B) Authentication  
(C) Access control (D) Certification



# EVALUATION

**8. Which of the following members of a class can be handled only from within the class?**

- (A) Public members
- (B) Protected members
- (C) Secured members
- (D) Private members

**9. Which members are accessible from outside the class?**

- (A) Public members
- (B) Protected members
- (C) Secured members
- (D) Private members

**10. The members that are accessible from within the class and are also available to its subclasses is called**

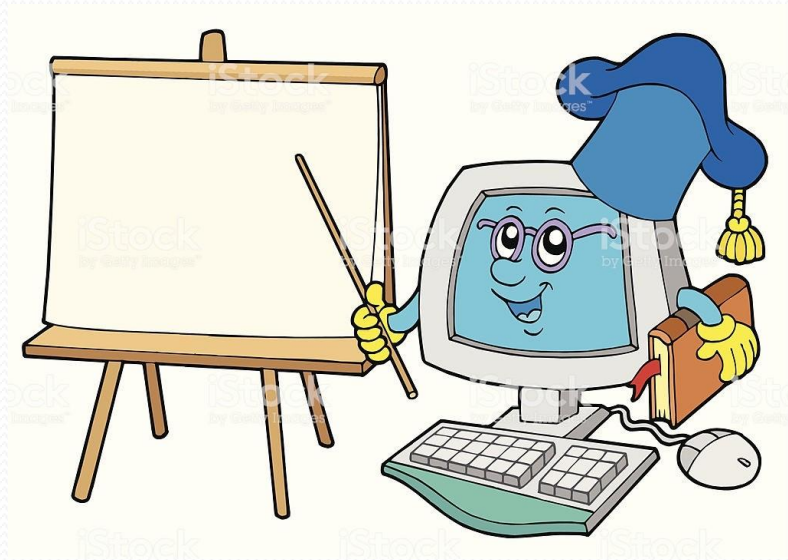
- (A) Public members
- (B) Protected members
- (C) Secured members
- (D) Private members

## Important questions:

1. What is a scope?
2. Why scope should be used for variable. State the reason.
3. What is Mapping?
4. What do you mean by Namespaces?
5. How Python represents the private and protected Access specifiers?
6. Why access control is required?
7. Explain the types of scopes for variable or LEGB rule with example.
8. Write any Five Characteristics of Modules.
9. Write any five benefits in using modular programming.

# THANK YOU!!!

*Education is the most powerful weapon which you can use to change the world.*



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