Programming Or Implementation Phase

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Programming Or Implementation Phase

Transcribing the logical flow of solution steps in flowchart or algorithm to program code and run the program code on a computer using a programming language.

Programming phase takes 5 stages:

- Coding.
- Compiling.
- Debugging.
- Run or Testing.
- Documentation and maintenance.

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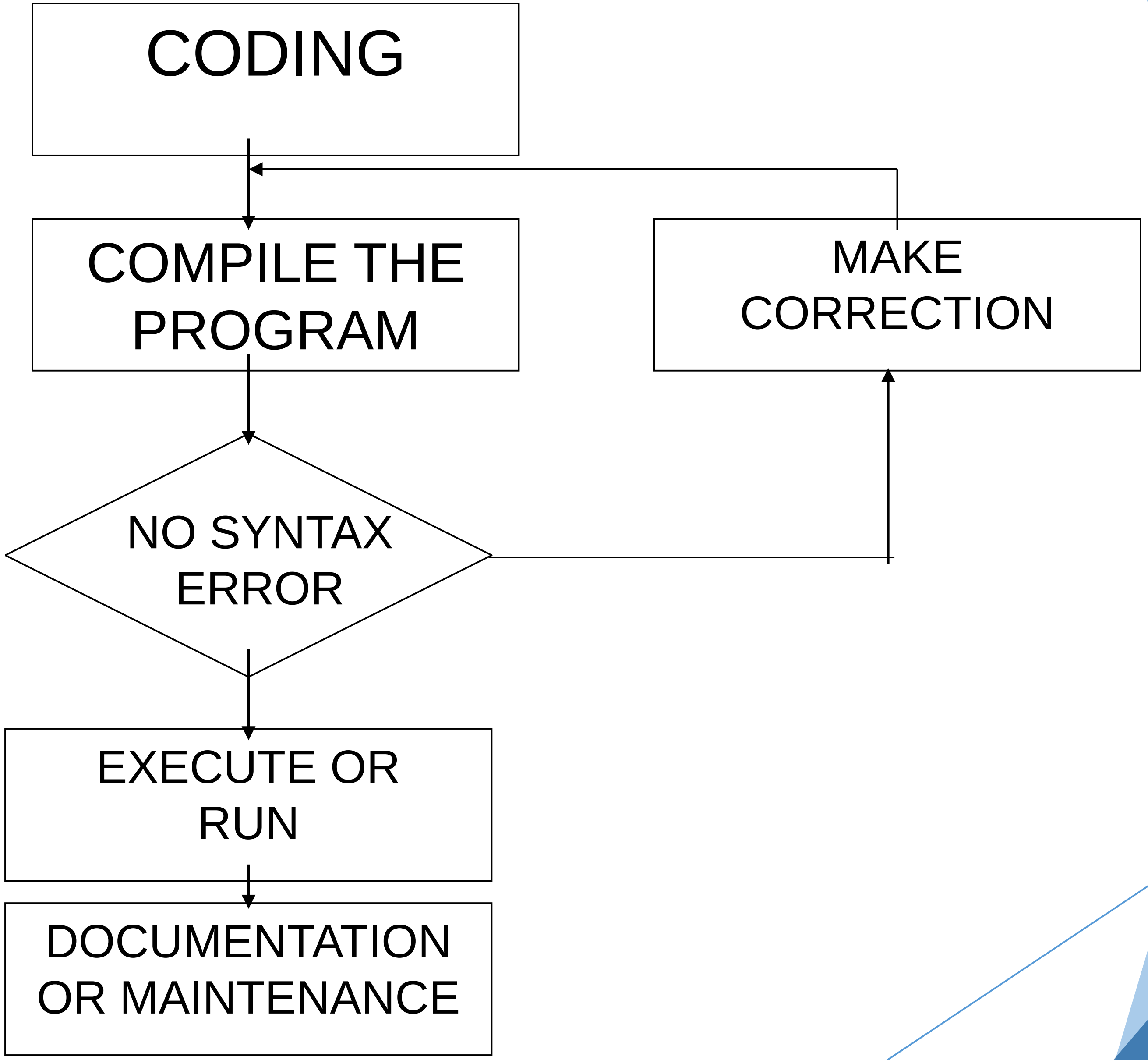
- Once the program is coded using one of the programming language, it will be compiled to ensure there is no syntax error. Syntax free program will then be executed to produce output and subsequently maintained and documented for later reference.



CODING

COMPILE THE PROGRAM

NO SYNTAX ERROR

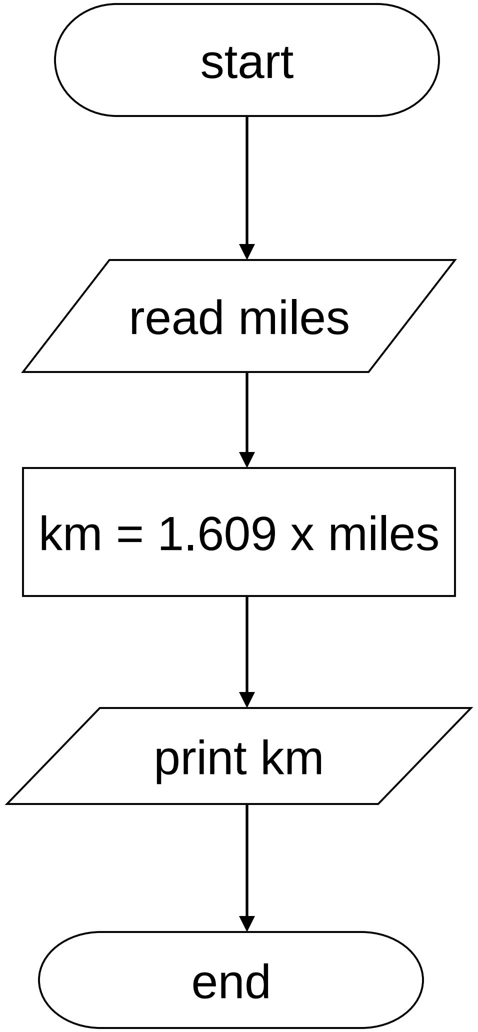
MAKE CORRECTION

EXECUTE OR RUN

DOCUMENTATION OR MAINTENANCE

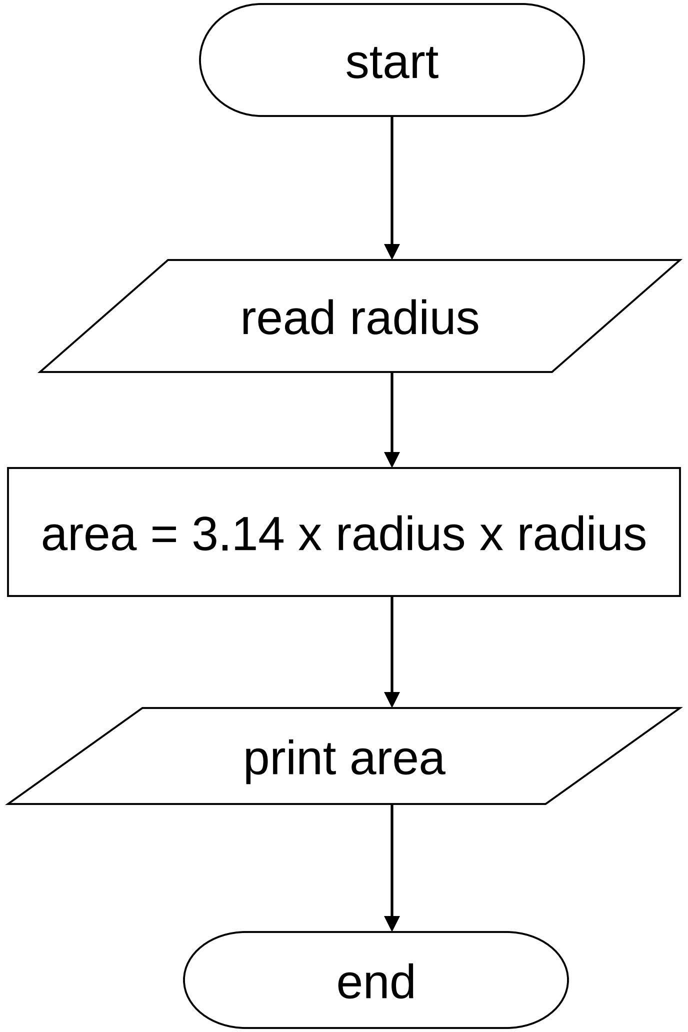
Problem 1

Write a Problem Analysis Chart (PAC) to convert the distance in miles to kilometers where 1.609 kilometers per mile.


start
read miles
km = 1.609 x miles
print km
end

Problem 2

Write a Problem Analysis Chart (PAC) to find an area of a circle where area = pi * radius * radius


start
read radius
area = 3.14 x radius x radius
print area
end

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Coding

- Translation or conversion of each operation in the flowchart or algorithm (pseudocode) into a computer-understandable language.
- Coding should follow the format of the chosen programming language.

Many types or levels of computer programming language such as:

- Machine language
- Symbolic language or assembly language
- Procedure-oriented language

The first two languages are also called low-level programming language. While the last one is called high-level programming language.

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✓ Machine Language

- Machine language uses number to represent letters, alphabets or special character that are used to represent bit pattern.
- Example:

an instruction to add regular pay to overtime pay, yielding total pay might be written in machine language as follows:

16 128 64 8

in which 16 is a code that mean ADD to the computer. The 128 and 64 are addresses or location at which regular pay and overtime pay are stored. The 8 represents the storage location for the total pay.

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Sometimes, bit pattern that represent letters and alphabets are used for coding.

Example:

Instead of:	16	128	64	8
Use:	10000	10000000	1000000	1000

This representation is ideal for a computer but difficult and tedious to the programmer to write a lengthy program.

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- ✓ **Symbolic Language or Assembly Language**

A symbolic language or assembly language is closely related to machine language in that, one symbolic instruction will translate into one machine-language instruction.

Contain fewer symbols, and these symbols may be letters and special characters, as well as numbers.

As example, a machine language instruction

```
16   128   64   8
```

can be rewritten in assembly language as

```
ADD   LOC1   LOC2   LOC3
```

Which means, add content of location LOC1 to location LOC2 and put the result in location LOC3.

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✓ **Procedure - Oriented Language**

- Programmer has to know the computer hardware before he can write program in machine and assembly language. It means the language is machine dependent.
- Using procedure – oriented language, the programmer can run the program in any computer hardware.
- A special program called a *compiler* will translate program written using procedure – oriented language to machine language.

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- Some example of the language:
- COBOL (COmmon Business Oriented Language)
- FORTRAN (FORmula TRANslation)
- Pascal
- C
- C++
- BASIC, etc.
- These languages are also called *high-level programming language*

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Computer Language	Instruction Format
Machine language	16 128 64 8
Assembly language	ADD LOC1 LOC2 LOC3
BASIC	LET T = R + 0
FORTRAN	TOTAL = RPAY + OPAY
COBOL	ADD RPAY, OPAY GIVING TOTAL
Pascal	TOTAL : = RPAY + OPAY
C	TOTAL = RPAY + OPAY

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✓ **Compiling and Debugging**

- Compiling is a process of a compiler translates a program written in a particular high-level programming language into a form that the computer can execute.
- The compiler will check the program code known also as source code so that any part of the source code that does not follow the format or any other language requirements will be flagged as syntax error.
- This syntax error in also called bug, when error is found the programmer will debug or correct the error and then recompile the source code again.
- The debugging process is continued until there is no more error in the program.

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✓ Testing

- The program code that contains no more error is called executable program. It is ready to be tested.
- When it is tested, the data is given and the result is verified so that it should produced output as intended.
- Though the program is error free, sometimes it does not produced the right result. In this case the program faces logic error.
- Incorrect sequence of instruction is an example that causes logic error.

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✓ Documentation and Maintenance

- When the program is thoroughly tested for a substantial period of time and it is consistently producing the right output, it can be documented.
- Documentation is important for future reference. Other programmer may take over the operation of the program and the best way to understand a program is by studying the documentation.
- Trying to understand the logic of the program by looking at the source code is not a good approach.
- Studying the documentation is necessary when the program is subjected to enhancement or modification.
- Documentation is also necessary for management use as well as audit purposes.

Cohesion and Coupling

- Especially important concepts to the modern programmer, who in all probability will be working with many other programmers on the same problem.
- Cohesion allows a programmer to write a module of a large program and test it independently.
- Coupling allows all programmers to use necessary variables without losing the cohesion.

Cohesion

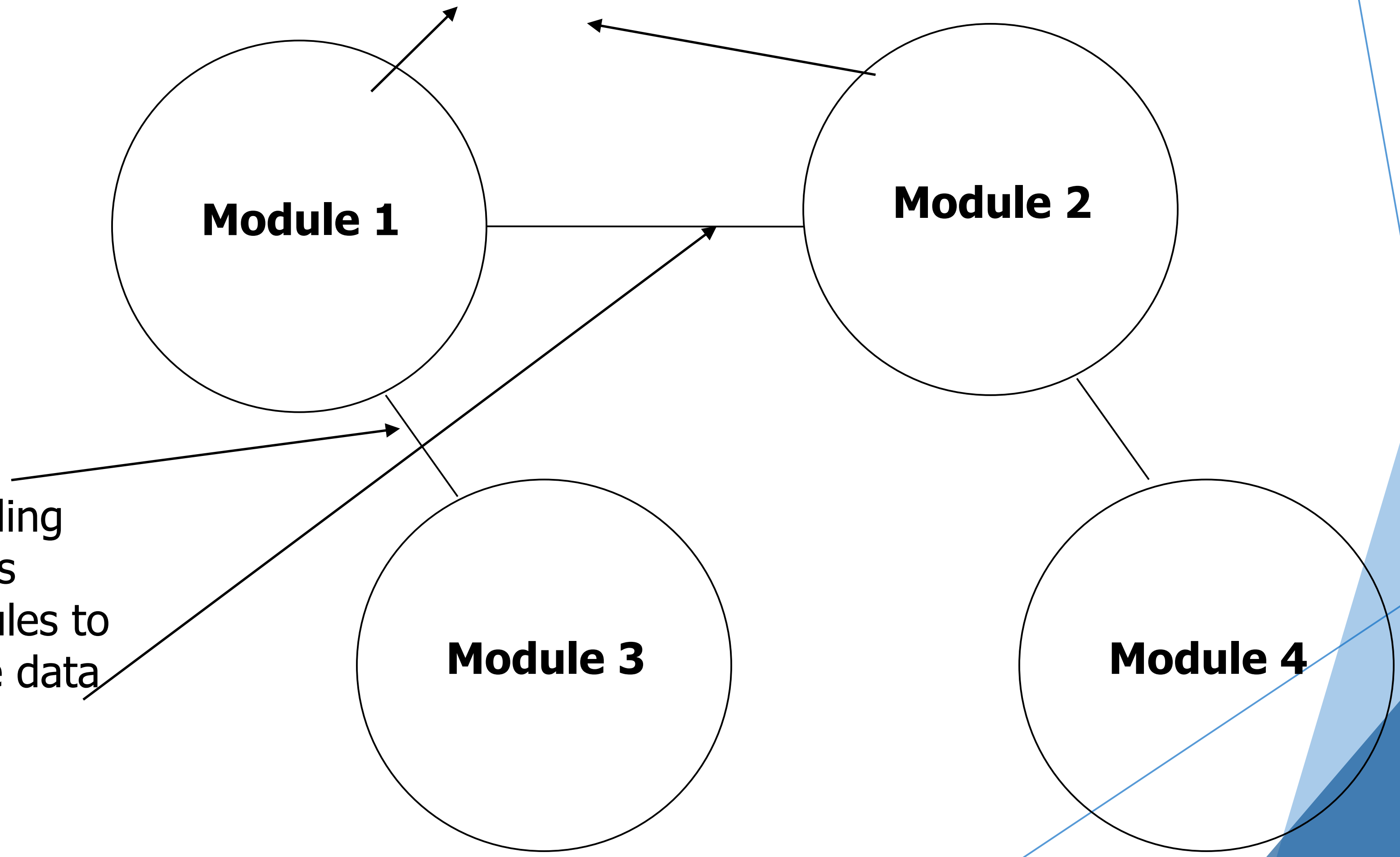
- Cohesion relates to the functional independence of the module and to the performance of a single task within the module.
- The objective is to separate the problem into parts.
- Each module is independent of each other module, with single entrance and a single exit, such as entering data, printing data, initialising data.

Coupling

- Coupling allows modules to be connected by an interface, which enables the programmer to transfer data from one module to another.
- Three coupling techniques are:
  - Parameter
  - Modules names
  - Global variables.
- Allows for communication between modules.
- Coupling allows all programmers to use necessary variable without losing the cohesion of the module.

Cohesion and Coupling

Cohesion is the ability for each module to be independent of other modules.



Coupling allows modules to share data

The Modules and The Functions

- The programmer breaks the problem into modules, each with specific function.
- It is much easier to write and test many small modules than a single large program.
- Modules are arranged according to processing order in interactivity chart.

The rules for designing modules

1. Each module is an entity and has one entrance and one exit.
2. Each module has a single function such as printing, calculating or entering data.
3. Each module is short enough to be easily read and modified.
4. The length of module governed by its function and the number of instruction to be executed.
5. A module is developed to control the order of processing.

Types of modules

1. Control module
   - Show the overall flow of data through the program. All other modules are subordinate to it.
2. Init module
   - Also called the preparation module, process instruction that are executed only once – at the beginning.
3. Process Data module
   - May be processed only once, or may be part of a loop.
     1. Calculation Modules
        - Do arithmetic calculations.

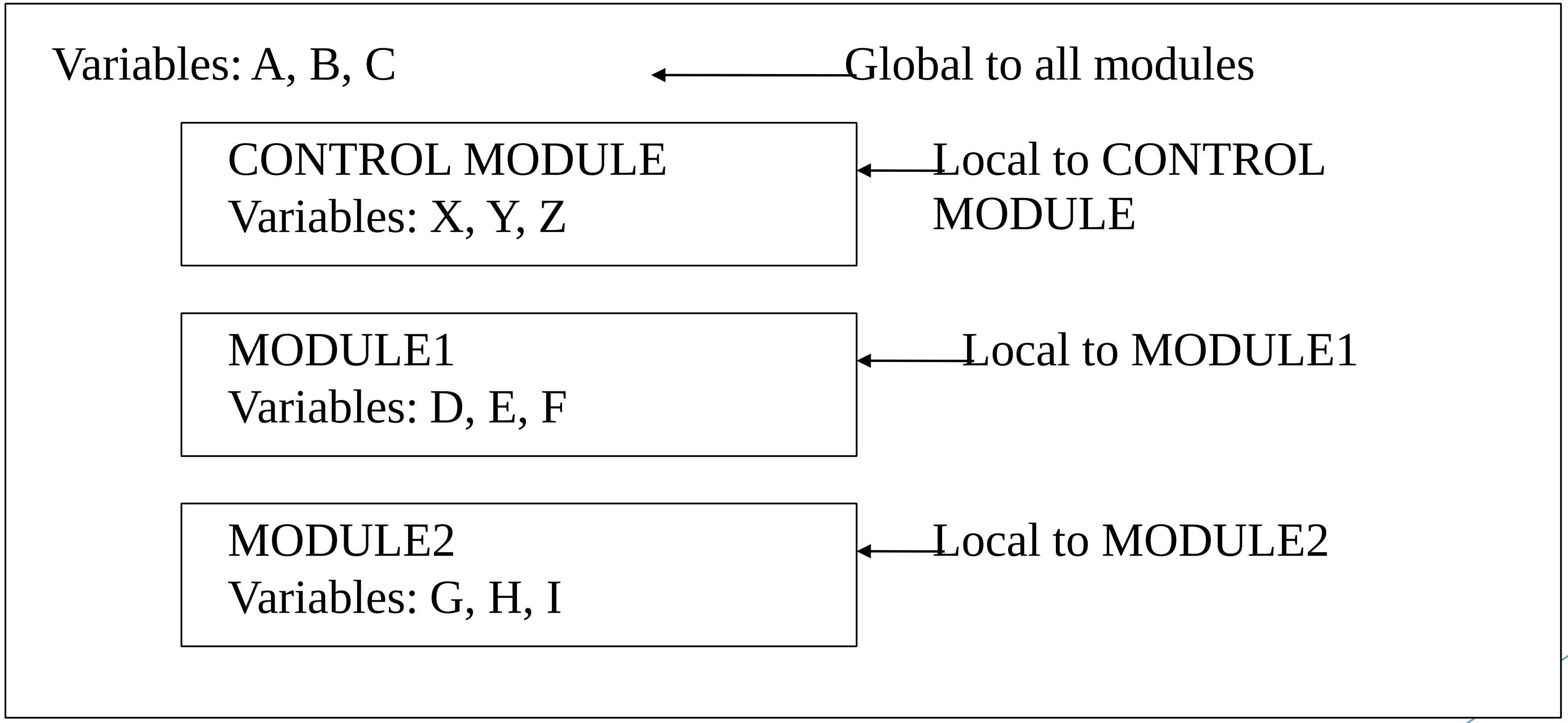
Types of modules

2. Print Modules
    - Print output lines.
3. Read and Data validation modules
    - Read or input data, validate data
    - Validation modules separate from read modules
4. Wrap-up module
    - Execute only once at the end.
    - Include closing file and printing totals.
5. Event module
    - Such as mouse down, mouse up, key entry.

Local and Global Variables

- The concept of local and global variables to allow cohesion and coupling to occur.
- Local variables
  - defined within a module
  - used only by the module itself
- Global variables
  - defined outside of the individual modules
  - can be used by all modules

Scope of Local and Global Variables



Variables: A, B, C

Global to all modules

CONTROL MODULE
Variables: X, Y, Z

Local to CONTROL MODULE

MODULE1
Variables: D, E, F

Local to MODULE1

MODULE2
Variables: G, H, I

Local to MODULE2

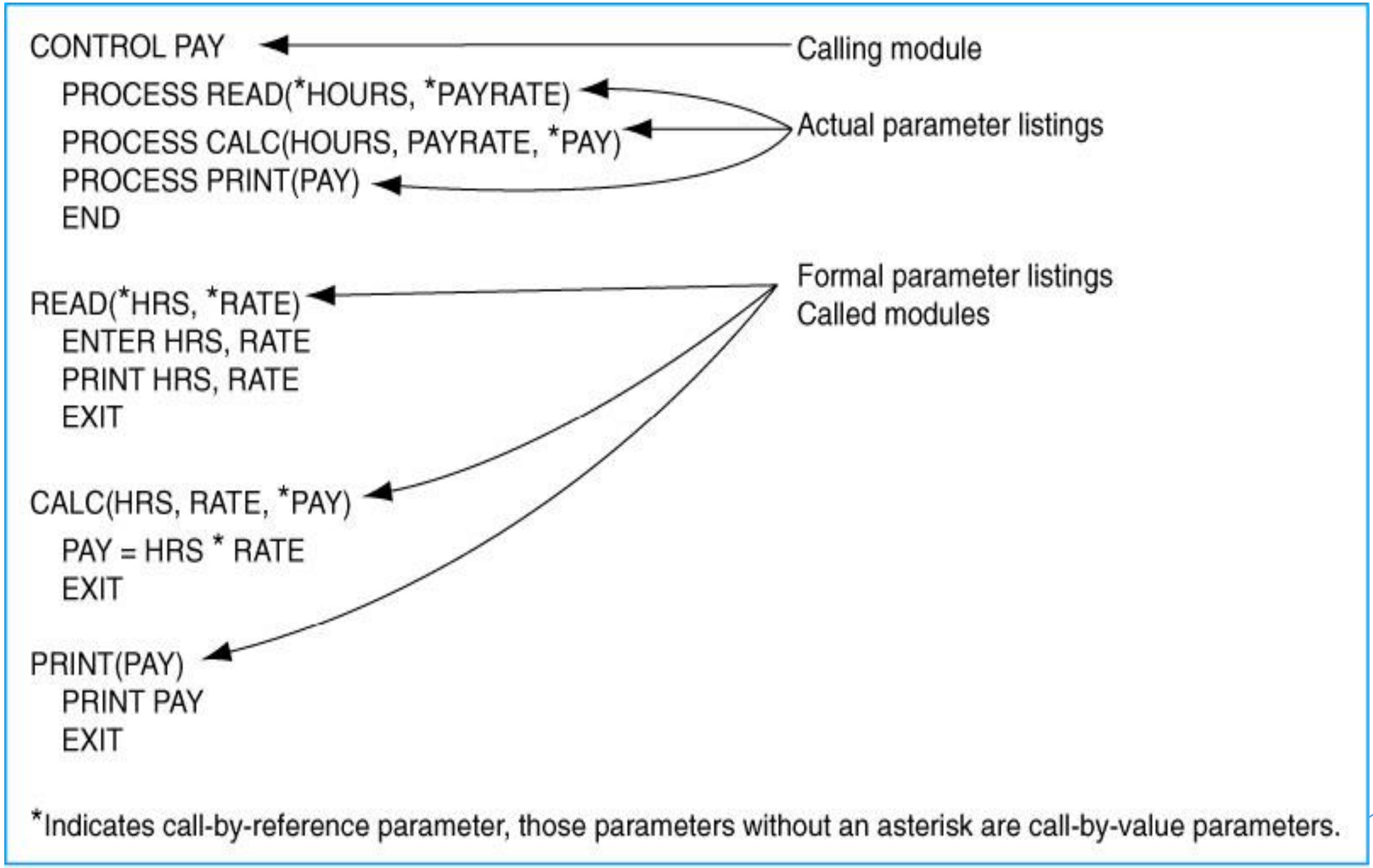
Parameters

- Parameters are local variables that are passed or sent from one module to another.
- Parameters are another way of facilitating coupling that allows the communication of data between modules.
- Eg: Read(A, B, C) – A, B & C are parameters
- There are two types of parameters:
  - Actual Parameter

    list of parameters that follow the module name being processed in the calling module
  - Formal Parameter

    list of parameters that follow the module name at the beginning of the module.

Parameter Terminology



```
CONTROL PAY
   PROCESS READ(*HOURS, *PAYRATE)
   PROCESS CALC(HOURS, PAYRATE, *PAY)
   PROCESS PRINT(PAY)
   END

READ(*HRS, *RATE)
   ENTER HRS, RATE
   PRINT HRS, RATE
   EXIT

CALC(HRS, RATE, *PAY)
   PAY = HRS * RATE
   EXIT

PRINT(PAY)
   PRINT PAY
   EXIT
```

*Indicates call-by-reference parameter, those parameters without an asterisk are call-by-value parameters.

Beginning Problem-Solving Concepts for the Computer

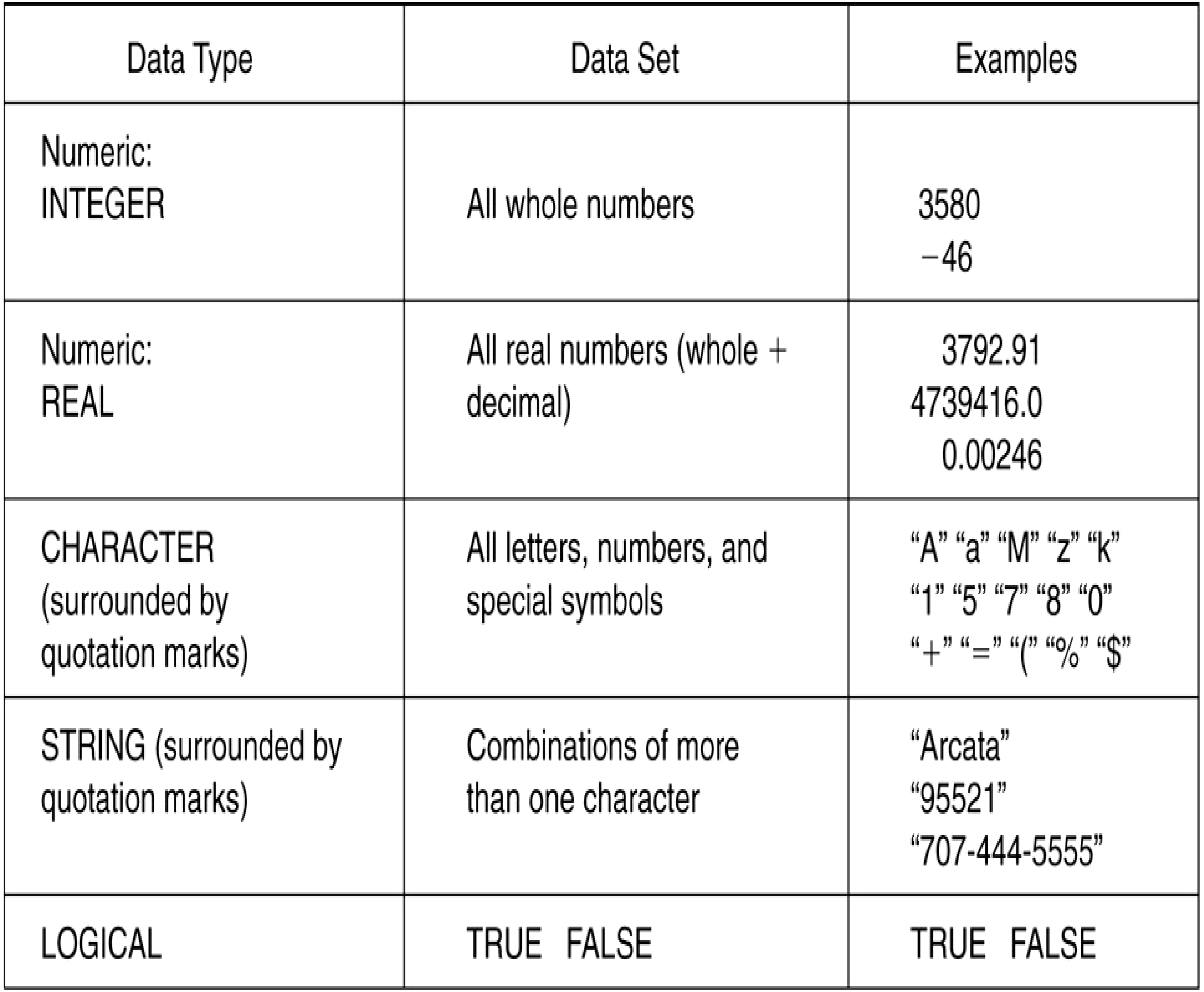
- Data used in processing
- **Constant** is a value that never changes during the processing of all instructions in a solution
- Constant is given a location in memory and a name.
- The value of a **variable** may change during processing

Rules for naming and using variables:

- Name according to what it represented
- Do not use spaces in a variable name
- Do not a dash
- Consistent in the use of variable names
- Consistent when using upper and lowercase characters

Data Types

- Data are unorganized facts
- Goes as input and is processed to produce output, information
- Computers must be told the data type of each variable and constant
- 3 common types: numeric, character, and logical
- Other data types: date data type and user-defined data types



Data Type	Data Set	Examples
Numeric: INTEGER	All whole numbers	3580 −46
Numeric: REAL	All real numbers (whole + decimal)	3792.91 4739416.0 0.00246
CHARACTER (surrounded by quotation marks)	All letters, numbers, and special symbols	“A” “a” “M” “z” “k” “1” “5” “7” “8” “0” “+” “=” “(” “%” “$”
STRING (surrounded by quotation marks)	Combinations of more than one character	“Arcata” “95521” “707-444-5555”
LOGICAL	TRUE FALSE	TRUE FALSE

Rules of Data Types

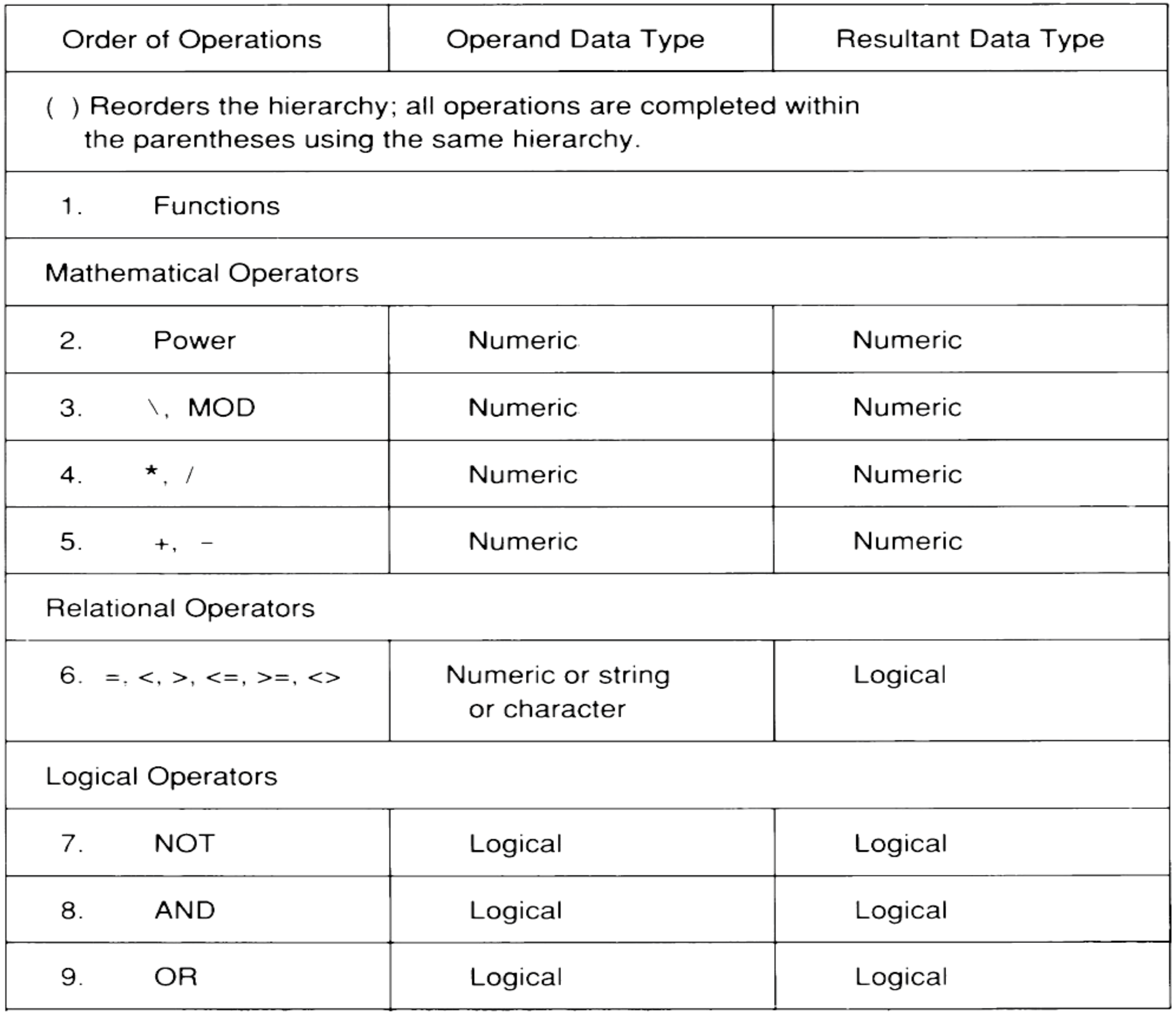
- Programmer designates the data type during the programming process
- Data types cannot be mixed
- Each data types used data set
- Calculations involved only numeric data type.

Functions

- Small sets of instructions that perform specific task and return values
- Used as part of instruction in a solution
- Divided into classes:
  - **Mathematical functions** – used in science and business
  - **String functions** – used to manipulate string variables
  - **Conversion functions** – used to convert data from one data type to another
  - **Statistical functions** – used to calculate things such as maximum value
  - **Utility functions** – access information outside the program, i.e. date and time function
- Functions use data, called parameters. Functions normally do not alter parameters
- Functionname(parameters list)

Operators

- They are data connectors within expressions and equations.
- They tell computer how to process the data
- **Operands** are data the operator connects and processes
- **Resultant** is the answer
- Data type of the operand and the resultant depends on the operator:
  - Mathematical operators
  - Relational operators
  - Logical operators
- Operators have a **hierarchy** or precedence



Order of Operations	Operand Data Type	Resultant Data Type
( ) Reorders the hierarchy; all operations are completed within the parentheses using the same hierarchy.		
1. Functions		
Mathematical Operators		
2. Power	Numeric	Numeric
3. \, MOD	Numeric	Numeric
4. *, /	Numeric	Numeric
5. +, -	Numeric	Numeric
Relational Operators		
6. =, <, >, <=, >=, <>	Numeric or string or character	Logical
Logical Operators		
7. NOT	Logical	Logical
8. AND	Logical	Logical
9. OR	Logical	Logical