Minggu-7 – Data & Ekspresi

Algoritma & Pemrograman Saintifik

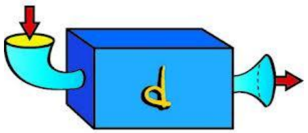
Gatot F. Hertono, Ph.D

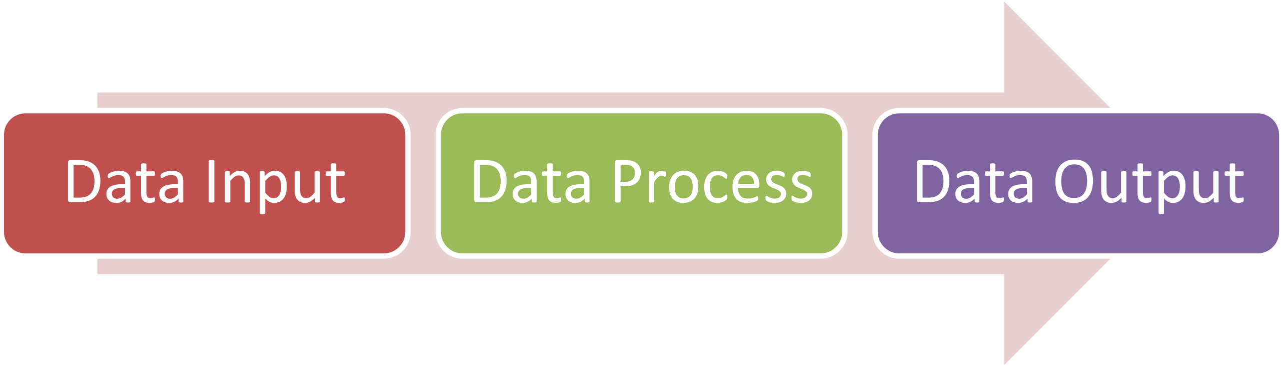
Departemen Matematika

SCMA601401

Data

- Computers are very good at manipulating data.
- Data is nothing more than information stored in an organized manner.
- Understanding how data is used in a program is vital to effective programming.
- Any programming language allows you **to store data** and **perform operations** using that data.





Data Input

Data Process

Data Output

- To understand exactly how to use any programming language, we must understand the information about data, variables, and constants.

Data Types

Numeric

Alphanumeric

Boolean (1/0)

Example

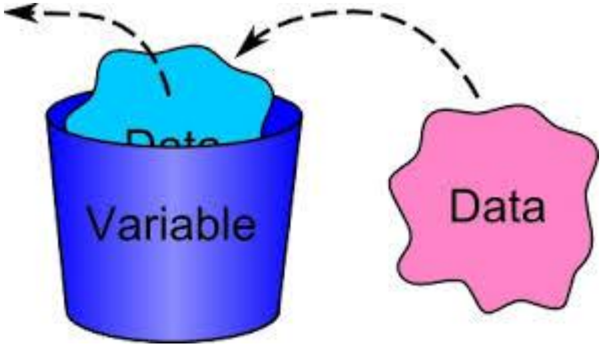
1
1000000000
-999
10.25
-5.2345
3.14285714
1,00E-5

‘z’
‘UI’
‘+’
‘123’
‘1E-5’
‘False’
‘Universitas Indonesia’
‘f(x) = x^2 – (3*x) + 10’
‘n! = n*(n-1)!’
‘Email: gfh308@gmail.com’

True
False
0
1

Note: in some programming languages, alphanumeric data is denoted by surrounding quote marks (“ … “ symbols)

Variables



- *Variables* are **storage places set aside in memory for the purpose of saving a particular data value**.
- It sometimes helps to think of variables as **a named container for values**. These containers are called variables because their contents can vary.
- Variables are powerful because they allow you to create general-purpose program statements that can act and make decisions based on the values within the variables.
- For instance, consider the following logical sentence:

*If I have enough **money**, I will go on a date tonight.*

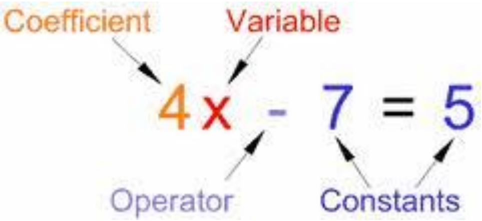
variable

Variables

Variable: A letter that represents an unkown number.

eg. x, a, n

In mathematical equation:



Coefficient

Variable

$4x - 7 = 5$

Operator

Constants

Some programming languages recognize string of alphabet (or combination of alphabet and numbers) as a variable names.

Example

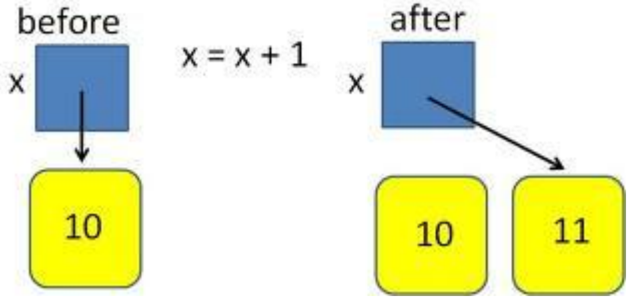
```
B1 = 10.5;
A1 = input(‘What is the current odometer reading?’);
A2 = input(‘How many gallons of gas did you pump?’);
Miles = A1 - B1;
Mileage = Miles/A2;
A = ‘The mileage is’;
Tally = Tally + 1;
disp(A);
disp(Mileage);
```

Note the contents of each variables

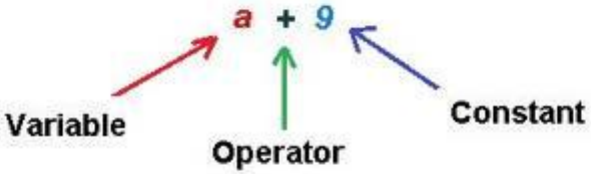
Expression

Expressions are the fundamental means of specifying computations in a programming language

Expression is used to assign values to a variable (or to change the value of a variable)



Arithmetic expressions consist of operators, operands, parentheses, and function calls.



Example: Total = (Sum + (12*Salary)) * 1.5
Sol = (ln(n) + sin(1.5)) + Fact(n)

Notes

In an arithmetic expression, operator evaluation order is governed by:

- Precedence rules ((), unary ops, ** or ^, * and /, + and -)
- Associativity rules (typically is left ot right)

Some notes on Arithmetic Expression

Associativity Rules

Mathematically, associativity should not make a difference in arithmetic expression like A + B + C, but not in computer arithmetic.

Example: Suppose in the computer, the range of representable values is only from -8 to 7, and let A = 4, B = 4, C = -2, then

What is the value of A + B + C?

- A + (B + C) gives 6, but
- (A + B) + C will be arithmetic overflow

Operand Evaluation Order

A functional side effect occurs when a non-void method changes a two-way parameter

Designing A Program

Case Problem

Bila diberikan sejumlah data sebanyak *n* yang diinput satu per satu ke dalam suatu program, maka buatlah suatu algoritma (dapat dalam pseudocode atau flowchart) yang langsung memberikan output/hasil yang menghitung:

a. Jumlah nilai total dari seluruh *n* data tersebut;
b. Nilai rata-rata dari *n* data tersebut;
c. Nilai maksimum dari *n* data tersebut.

numerical variables

n → banyaknya data
d_i → data pada input ke-*i*
Tot → jumlah nilai total
Avg → nilai rata-rata
Maks → nilai maksimum

$\text{Tot} = \sum_{i=1}^{n} d_i$

Avg = Tot / n

Maks $\geq d_i$, untuk setiap *i*

How do you combine those information into a program?

The Program

In Matlab codes:

```
clear all;

n = input('Jumlah Data: ');
% Inisialisasi Variabel
Tot = 0;
Avg = 0;
Maks = -9999999;

% Input data & compute Total and Maksimum
display('Masukkan data: ');
for i=1:n
    d_i = input('?')
    Tot = Tot + d_i;
    if (d_i >= Maks)
        Maks = d_i;
    end
end

% Dislay solutions
Avg = Tot/n;
display('Total = '), disp(Tot);
display('Average = '),disp(Avg);
display('Maksimum = '),disp(Maks);
```