Algorithm and Data Structure II

Addin Aditya, S.Kom., M.Kom

Department of Information System

SEKOLAH TINGGI INFORMATIKA DAN KOMPUTER INDONESIA

MAIN SUBJECT

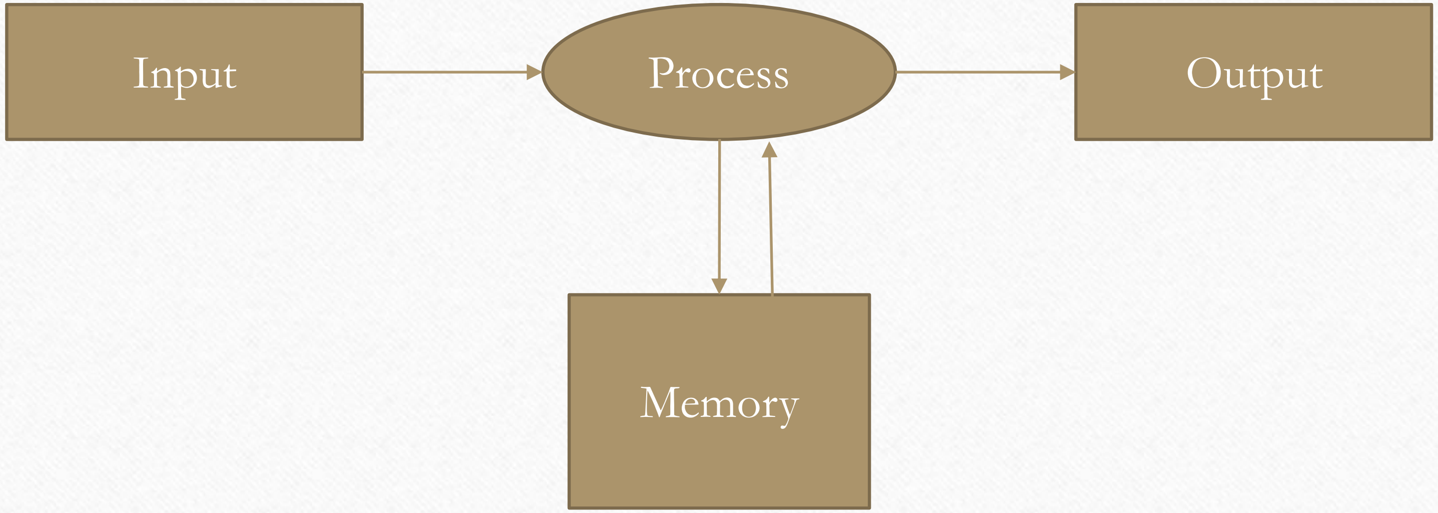
- Introduction to Algorithm
- Data type and Operator
- Condition
- Recursion
- Array and String
- Sorting and Searching
- Queue and Stack
- Linked List
- Tree
- Hash Table
- Graph Theory

Introduction

- Three main component of computer system → hardware, software, human
- Logic steps of solving problems
- Founded by Abu Ja’far Muhammad Ibnu Musa al-Khuwarizmi

Algorithm as Informatics Center of Interest

Every part of our lives can be described with an algorithm



Notation

- Flowchart or pseudo-code
- Can be described with sentences
- Pseudo code → programming language
- In this section we use JAVA

Flowchart

- Flowchart is a scheme / chart with particular symbols that describing the sequences of process and its connection clearly
- There are 4 kind of flowchart (Sterneckert, 2003):
  - Document flowcharts
  - Data flowcharts
  - System flowcharts
  - Program flowchart

Notation	Name	Information
→	Flow	Describing direction of process
⬬	Terminator	Start / end
▬	Process	What happen in flow chart
◆	Decision	Yes or no condition
▰	Input / Output	Receiving and displaying processed data

Example..

- Please describe the solutions with flowcharts and descriptive solution !
- There are 3 goats and 3 tigers want cross the river with a boat
- Rules:
  - Boat can only contain 2 animals and need 1 to drive it
  - You can win this game if you can bring all the animals cross the river safely
  - Warning, if the number of tiger is more than the number of goat, then tigers will eat the goat and you will lose !

Pseudo-Code

- Every solution declared with a statement and followed by an action that can be executed

```
write “hello world”
```

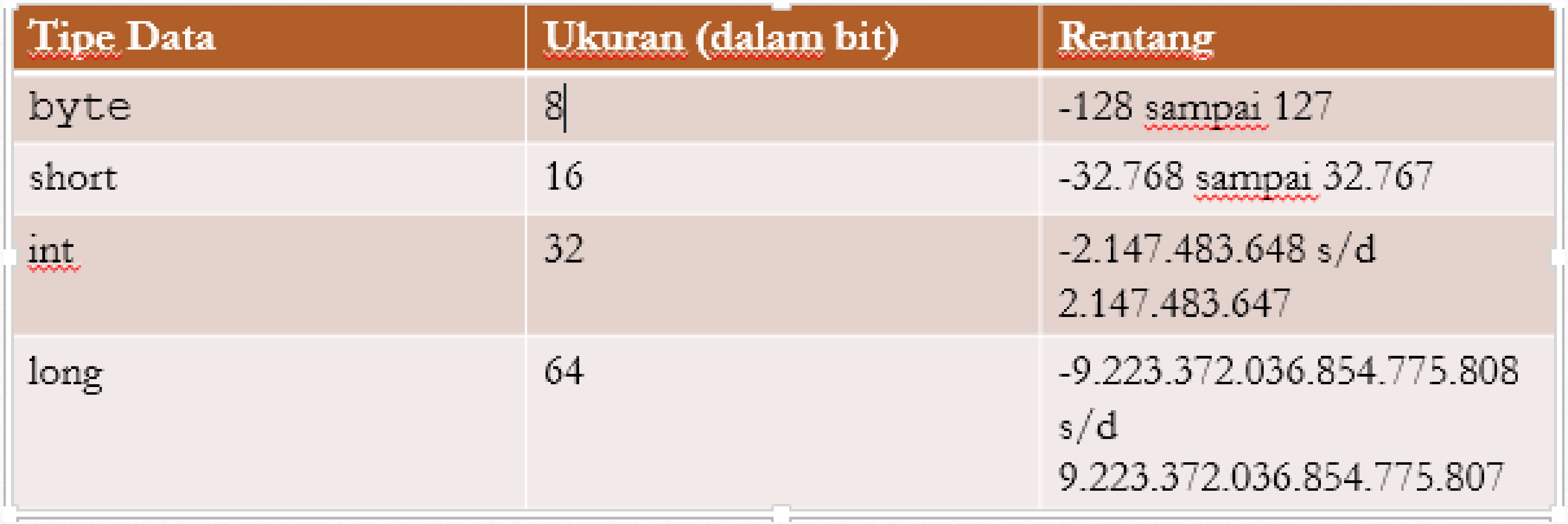
Data Types and Operator

Intro

- Object type determining of collection of value and what kind of operation can do to the object
- there are two kind of data type
  - Basic type
  - Formed type

Basic Type

- Logic, char, integer, float and string
- logic →
  - Boolean
  - Only true or false
- Integer is only 1,2,3,….



Tipe Data	Ukuran (dalam bit)	Rentang
byte	8	-128 sampai 127
short	16	-32.768 sampai 32.767
int	32	-2.147.483.648 s/d 2.147.483.647
long	64	-9.223.372.036.854.775.808 s/d 9.223.372.036.854.775.807

Clustering of Data Type

- Integer → `byte`, `short`, `int` and `long`
- Floating-point → `float` and `double`
- Character → `char`
- Boolean → `Boolean` (true/false)

Operator

- How to declare →

```
Var
  x : byte;
```

- Operator →
  - + → add
  - - → minus
  - * → times
  - Div
  - Mod

- < → less than
- > → more than
- >= → more than or equal too
- <= → less than or equal too
- = → equal too
- != → not equal too

Floating-point

- E notation means degree 10
- Usually called real or floating point
- To represented variable that containing floating number
- `Float` is used to describe variable that containing floating number with single precision
- `Double` is used to describe variable that containing floating number with double precision

Character

- Letter, sign, etc.
- Every data that located between (‘…’) will declared as char

Declaring a Variable

- Must start with letter / alphabet
- Uppercase is allowed
- No space. You can use (_) as a separator
- No math operator
- No limitation of length

Formed Type

- Array → containing data with same type
- String → collection of char
- Record → containing data with different type

Expression

- Data transformation and variable in equation and related by operator and operand
- Operand is data, variable or result from a function
- Operator is a symbol that has a function to connecting operand

- operator
  - arithmetic
  - relational
  - logic
  - string

Example

Please arrange an algorithm to calculate added value tax 12.5% from the goods price. First: input / read the price, count the tax, count the amount of the price then display!

- Added value tax algorithm

{counting added value tax from the goods price}

- Define variable

```
 real price, tax, total;
```

- Algorithm

```
write (“input price”);
read(price);
  tax ← 0.125 * price;
  total = price + tax;
  write(“price = ”+,price,”tax is = ”,tax);
  write(“Total = ”,total);
```

Basic of Algorithm

- Sequence → has 2 or more statement
- Selection → statement will be executed with particular condition

```
if [condition] then
    ..action..
```

- Iteration → recursion

```
for [..] do
    ..action..
```

Looping (For)

Looping with for is controlled by 3 main things (initialization, controller, increment or decrement)

```
for (initialization; controller; inc/dec)
{
   //statement
}
```

Looping

doing a statement with particular repeatation

NIM	NAMA	ALAMAT	TELP
091110130	ADDIN	MALANG	123
091110134	HUSIN	SURABAYA	654
091110132	CATUR	JOMBANG	999

Looping

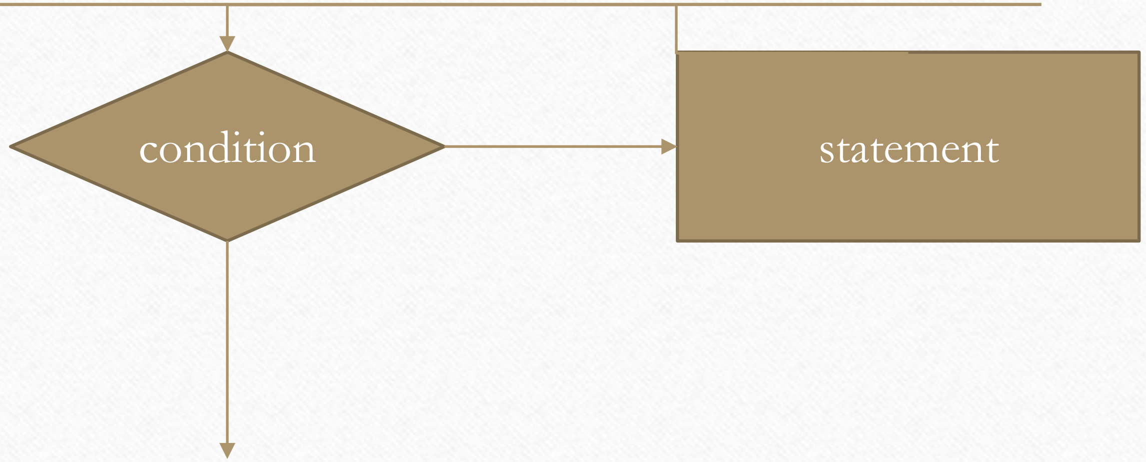
- While – do
- Repeat – until
- For
- Recursion
- Jump, break, continue, return

Perulangan while - do

- While (condition) do

  (statement)

  endwhile.

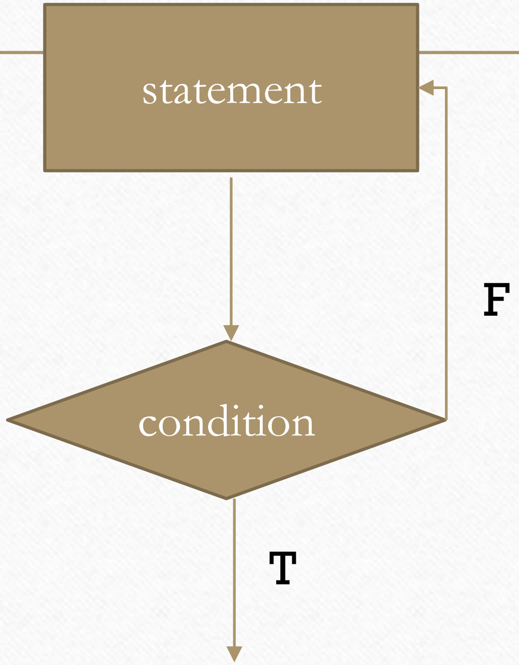


Example of while-do

```
Var
   int angka;
Algoritma
   angka ← 1;
   while (angka < 101) do
  write (angka);
  angka ← angka + 1;
   endwhile.
```

repeat - until

```
repeat
    ……….
        //statement
    ……….
until (condition)
```



ineffective algorithm !

```
If NIM pada entry tabel=NIM yang dicari then
 ambil alamat dan telp dari NIM tsb
Else
   if NIM pada entry tabel=NIM yang dicari then
     ambil alamat dan telp dari NIM tsb
..dan seterusnya
```

Algorithm possibility

```
Tinjau entry pertama tabel
Repeat
  if NIM pada entry tabel=NIM yang dicari then
       ambil alamat dan telp dari NIM tsb
  else
       tinjau entry berikutnya di dalam tabel
Until NIM yang dicari ditemukan atau akhir dar tabel
```

Recursion

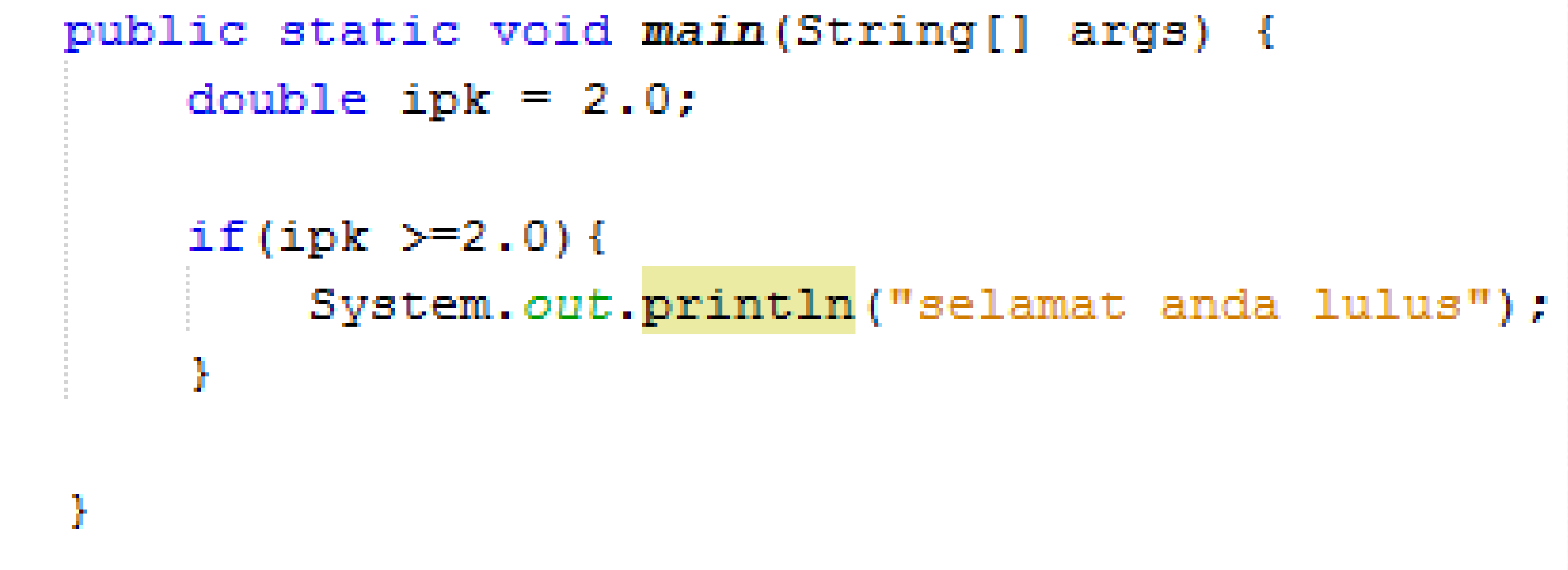
- Calling the method to do iteration
- Iteration will finish if the condition or the recursive variable is complete

Break, continue, return

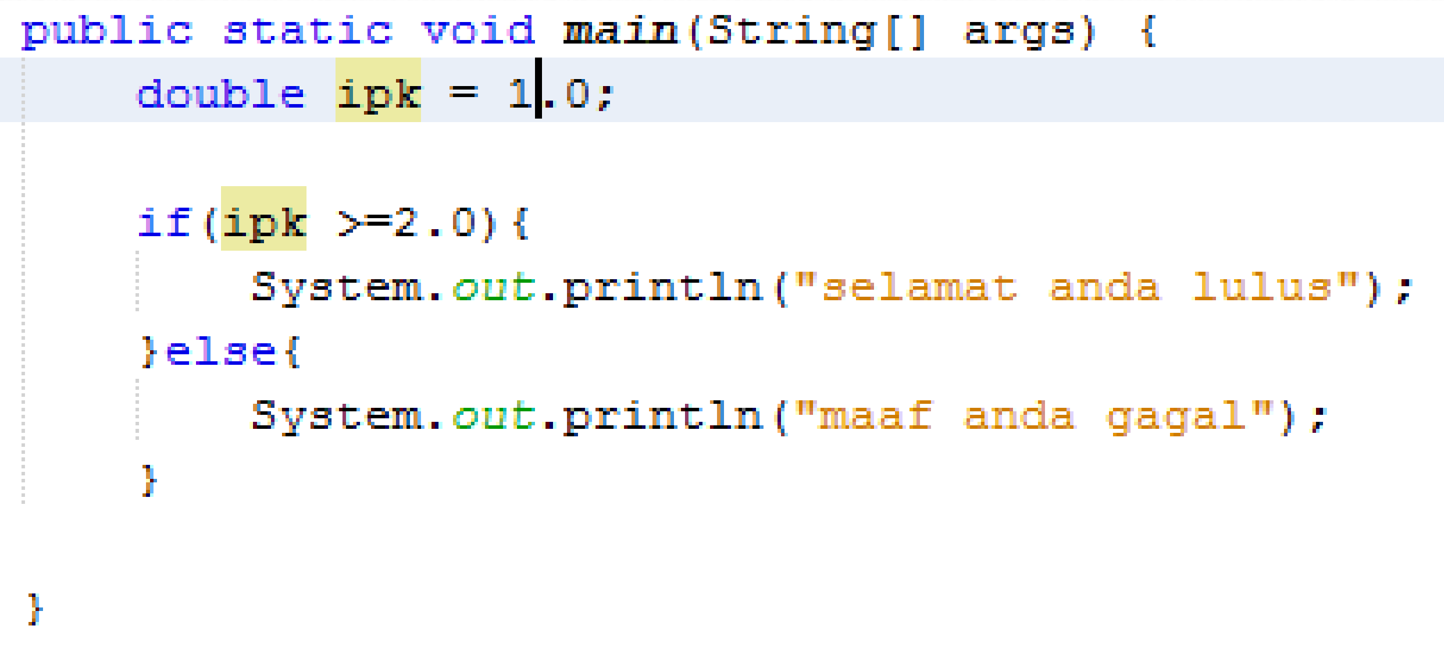
- With using ‘break’ we can end a looping without waiting the process done

Conditional Statement

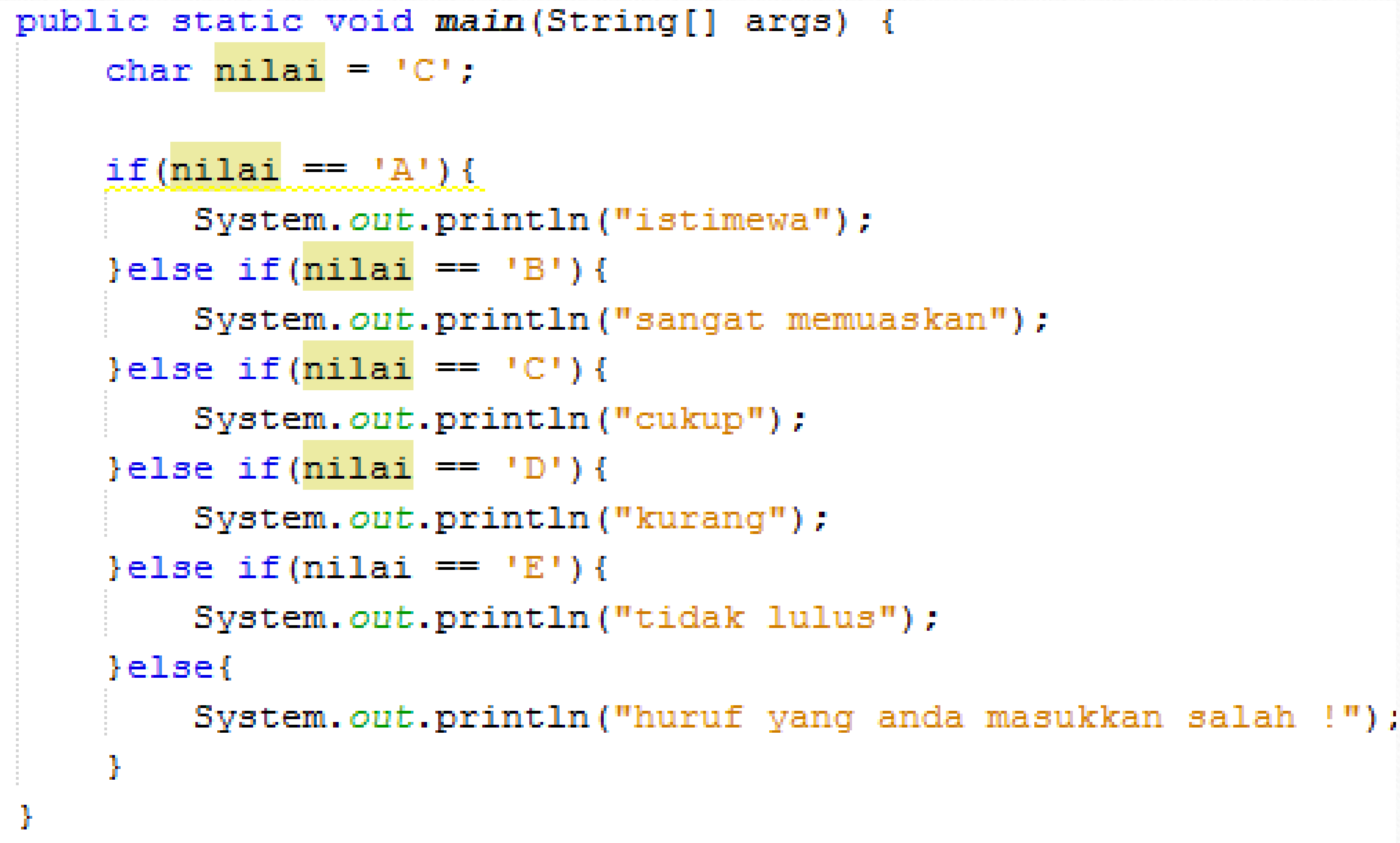
- If the condition is true, then do the statement
- **`If-else`** and **`switch`**



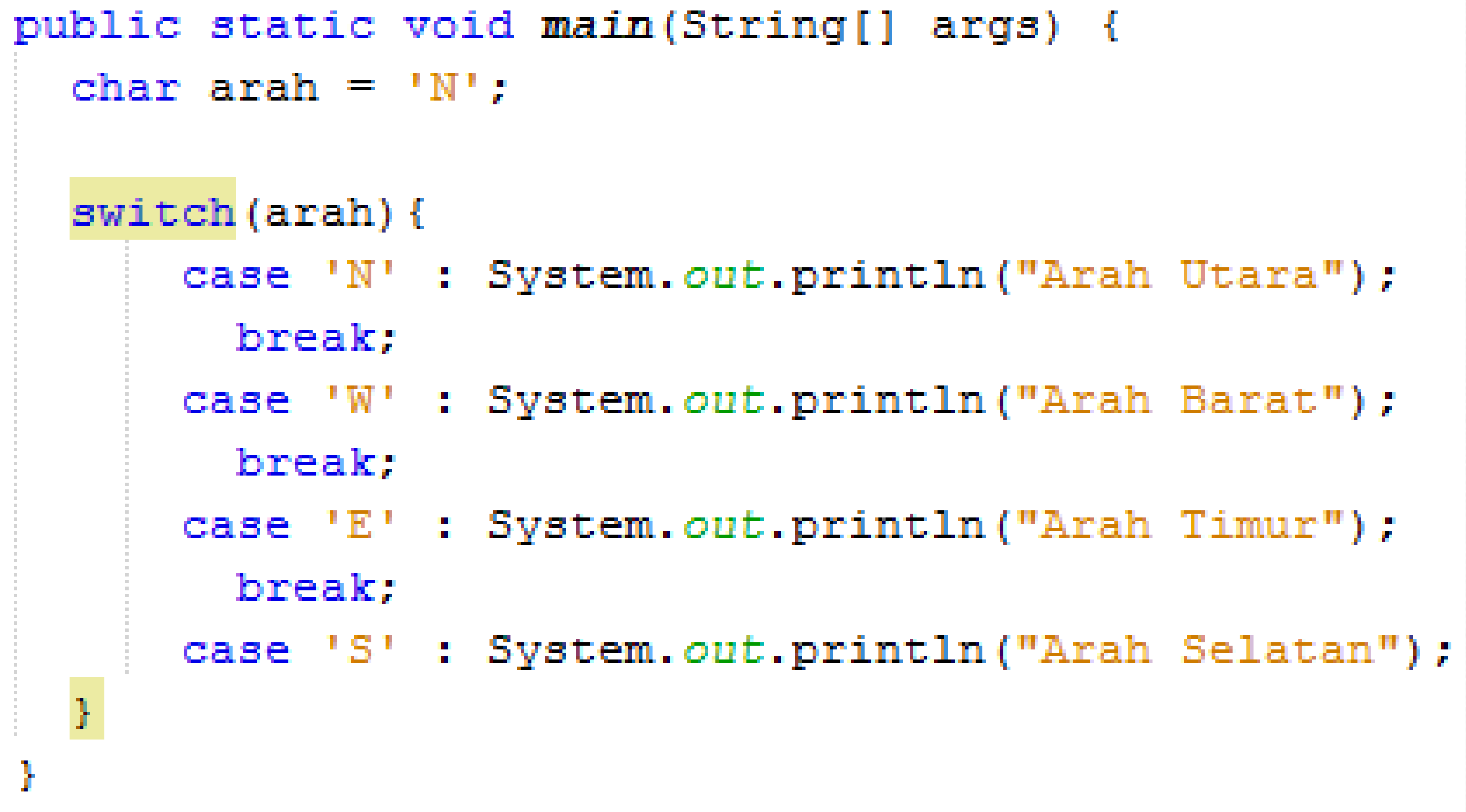
```
public static void main(String[] args) {
    double ipk = 2.0;

    if(ipk >=2.0){
        System.out.println("selamat anda lulus");
    }

}
```



```
public static void main(String[] args) {
    double ipk = 1.0;

    if(ipk >=2.0){
        System.out.println("selamat anda lulus");
    }else{
        System.out.println("maaf anda gagal");
    }

}
```



```
public static void main(String[] args) {
    char nilai = 'C';

    if(nilai == 'A'){
        System.out.println("istimewa");
    }else if(nilai == 'B'){
        System.out.println("sangat memuaskan");
    }else if(nilai == 'C'){
        System.out.println("cukup");
    }else if(nilai == 'D'){
        System.out.println("kurang");
    }else if(nilai == 'E'){
        System.out.println("tidak lulus");
    }else{
        System.out.println("huruf yang anda masukkan salah !");
    }
}
```



```
public static void main(String[] args) {
  char arah = 'N';

  switch(arah){
      case 'N' : System.out.println("Arah Utara");
        break;
      case 'W' : System.out.println("Arah Barat");
        break;
      case 'E' : System.out.println("Arah Timur");
        break;
      case 'S' : System.out.println("Arah Selatan");
  }
}
```