# IF 130 Programming Fundamentals

## 03 Flowchart of Repetition Control Structure

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# Course Learning Outcome:

Students are able to draw flowcharts with selection control structures, repetition control structures, and modularization control structures (C3).

# Review

- Algorithm can be defined as a set of *detailed*, *unambiguous* and *ordered instructions* developed to describe the **processes** necessary to produce the desired **output** from a given **input**.
- Flowchart and pseudocode are both popular ways of representing algorithms.
- There are 3 variations of **selection control structure**:
  - Simple IF statement
  - Null ELSE statement
  - Nested IF statement
- The **case structure** is another way of expressing a nested IF statement.

# Outline

1. Definition of repetition control structure
2. Kind of repetition control structure
3. Flowchart of repetition control structure
4. Exercises

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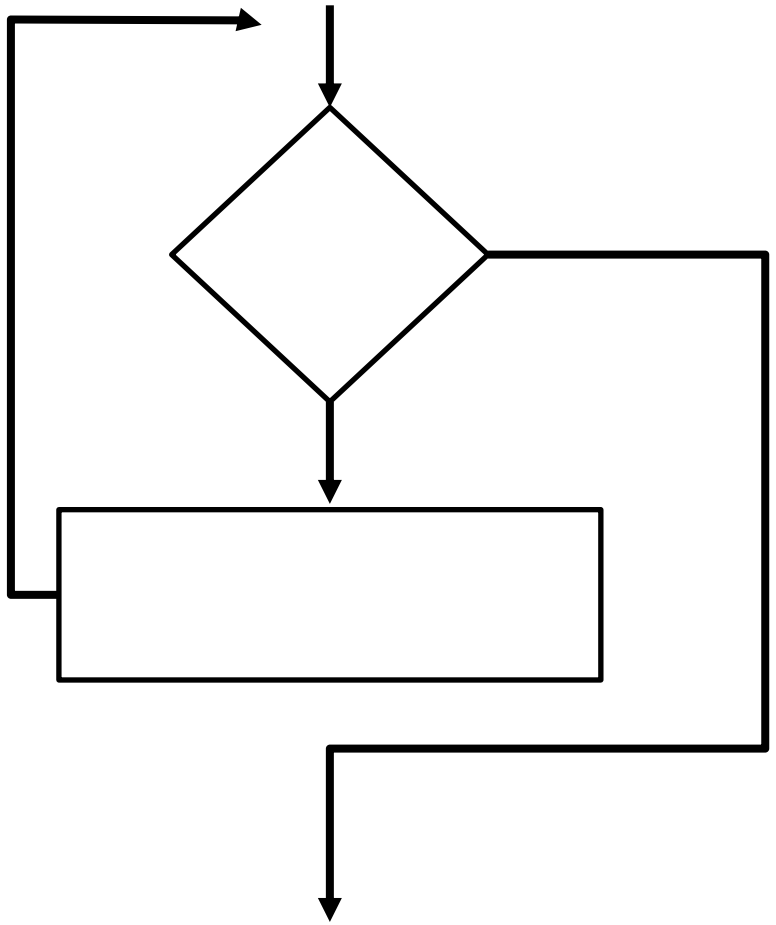
# DEFINITION & KIND OF REPETITION



# Repetition Essentials

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- A loop is a **group of instructions** the computer executes repeatedly while some loop repetition condition remains true.
- 2 kinds of repetition
  1. Sentinel-controlled repetition
  2. Counter-controlled repetition

# Sentinel-Controlled Repetition

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- Sentinel-controlled repetition is sometimes called **indefinite repetition** because it's not known in advance how many times the loop will be executed
- Sentinel values are used to control repetition when
  - The precise number of repetitions is not known in advance
  - The loop includes statements that obtain data each time the loop is performed

# Sentinel-Controlled Repetition

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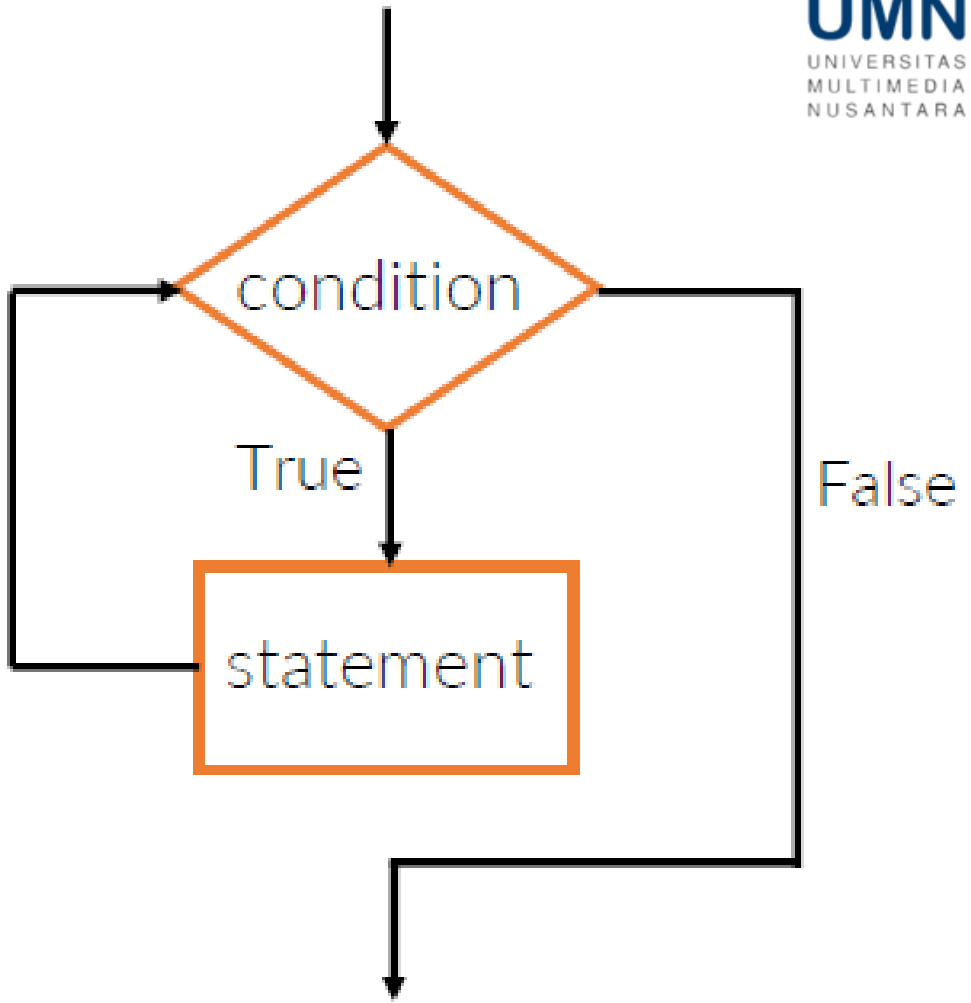
- **While**
- **Do-While**
- **Do-Until**
- Both the **While** and **Do-While** loops cause a statement or set of statements to repeat **as long as** a condition is **true**.
- The **Do-Until** loop causes a statement or set of statements to repeat **until** a condition is **true**.

# **WHILE** Loop

- "While a condition is true, do some task."
- The loop is repeated when the condition is true (when its value is not 0).
- The loop is exited when the condition is false.

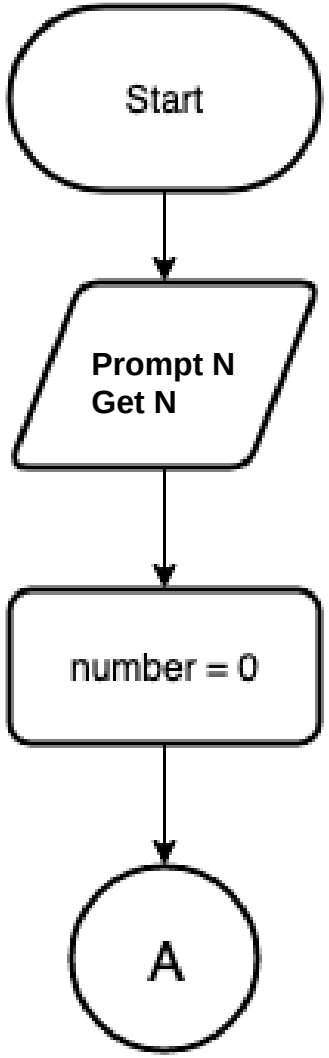


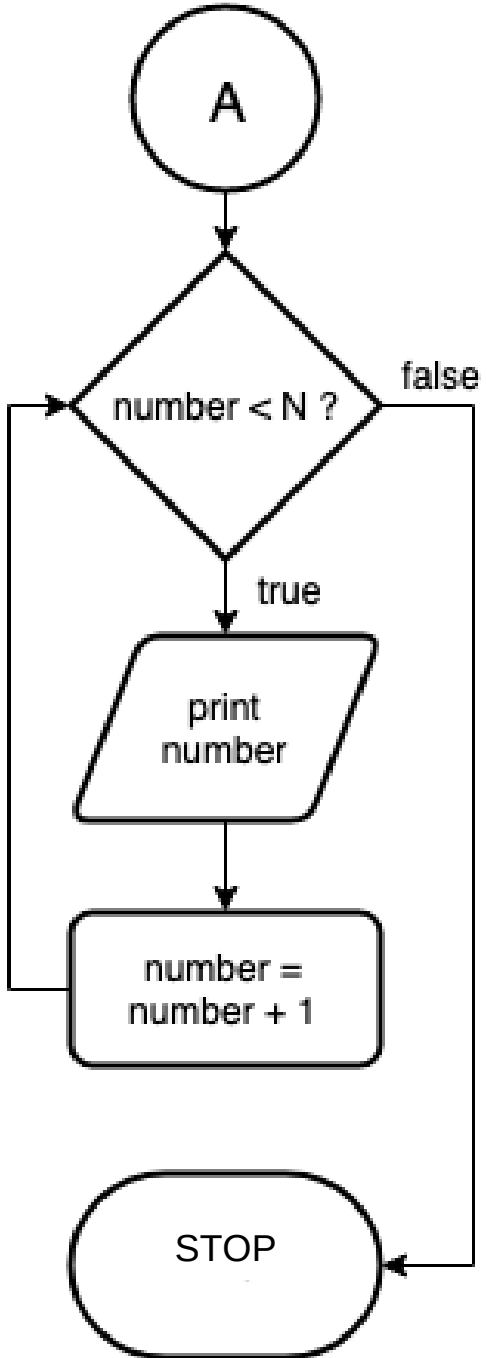
# **WHILE** Loop

**Program output**
**(with Input Shown in Bold)**

**10 [enter]**

0 1 2 3 4 5 6 7 8 9

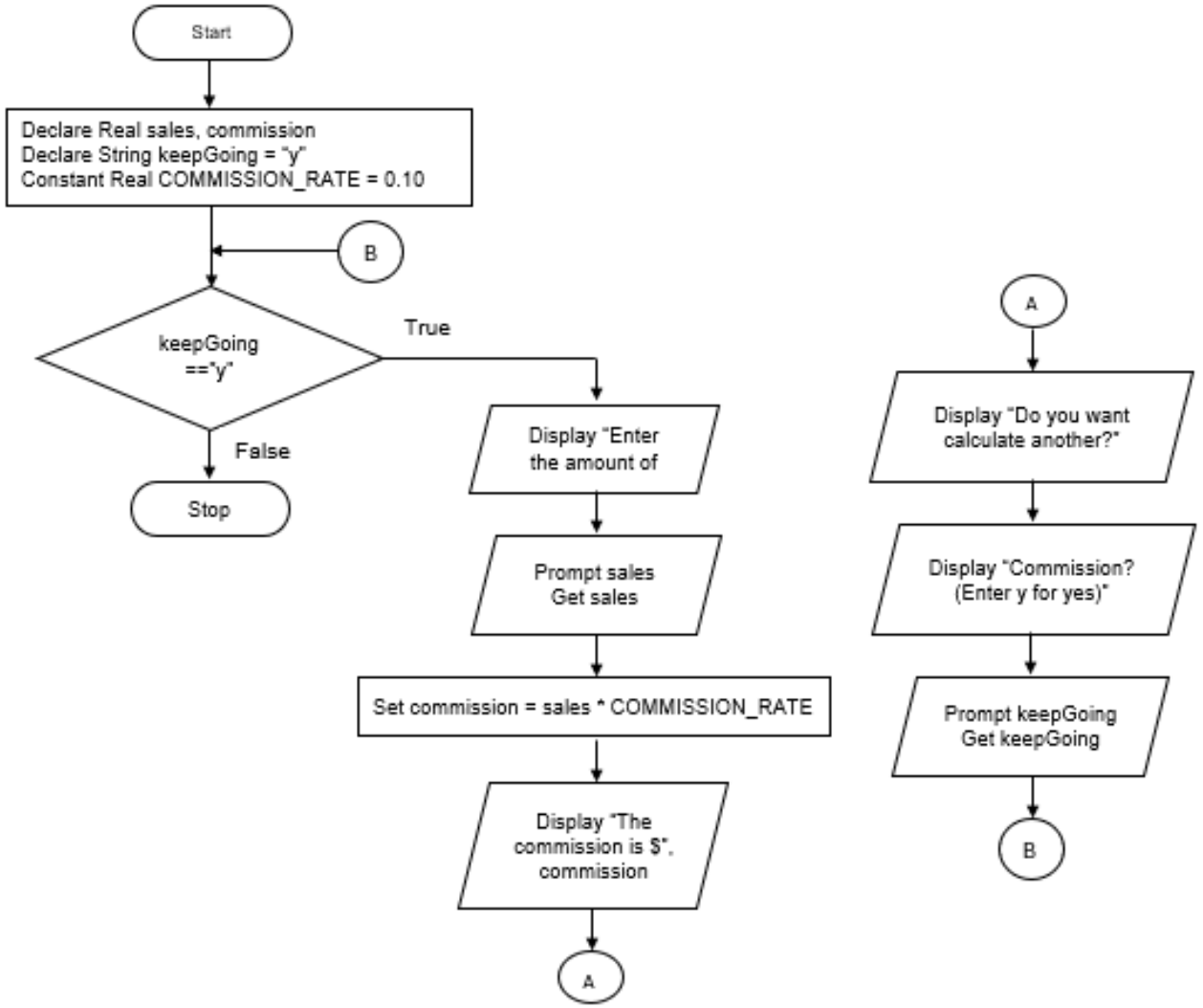


# **WHILE** Loop

**Program Output (with Input Shown in Bold)**

```
Enter the amount of sales.
10000.00 [Enter]
The commission is $1000
Do you want to calculate another
commission? (Enter y for yes.)
y [Enter]
Enter the amount of sales.
5000.00 [Enter]
The commission is $500
Do you want to calculate another
commission? (Enter y for yes.)
y [Enter]
Enter the amount of sales.
12000.00 [Enter]
The commission is $1200
Do you want to calculate another
commission? (Enter y for yes.)
n [Enter]
```



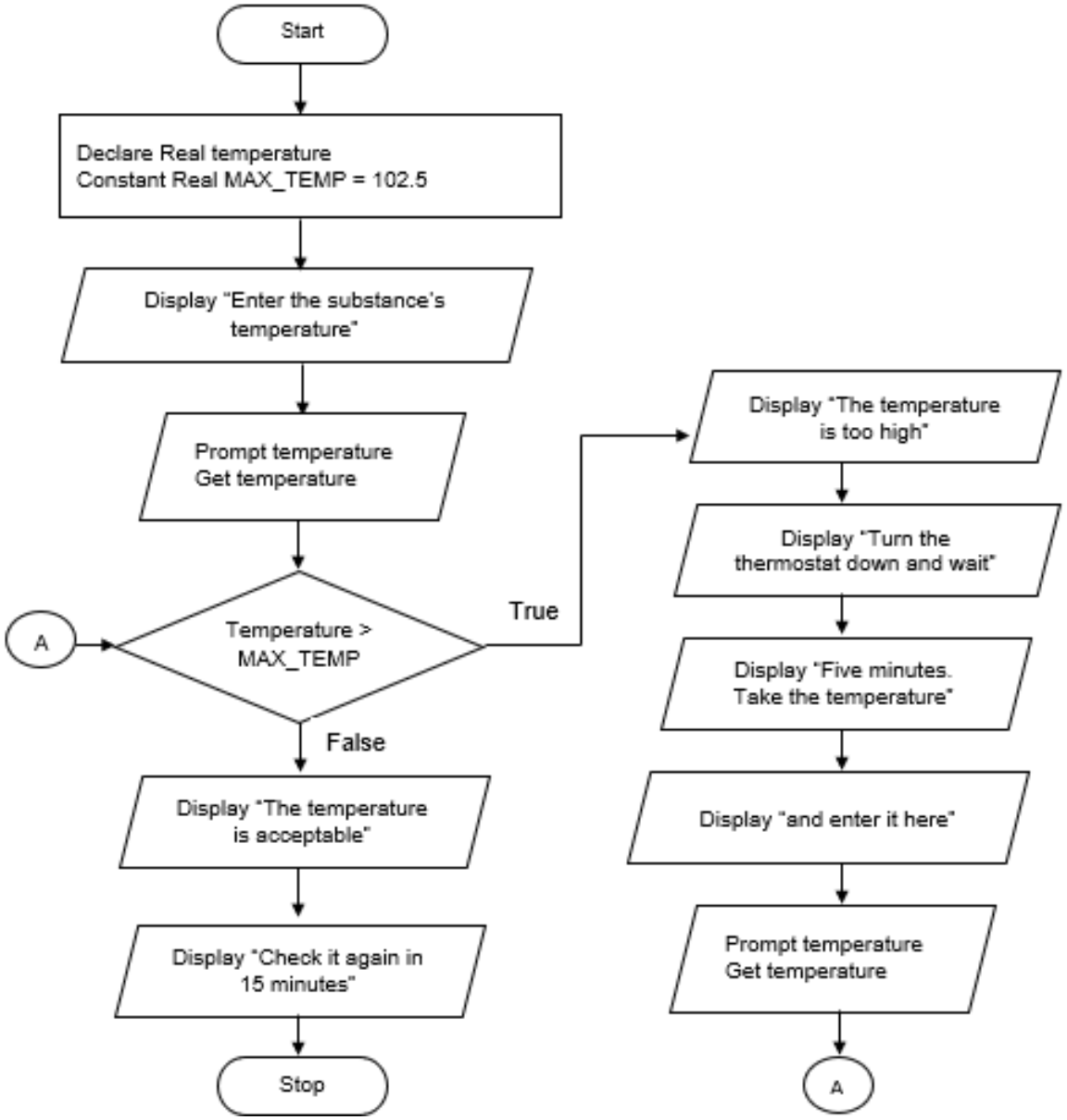
# **WHILE** Loop

**Program Output (with Input Shown in Bold)**

```
Enter the substance's temperature.
104.7 [Enter]
The temperature is too high.
Turn the thermostat down and wait
five minutes. Take the temperature
again and enter it here.
103.2 [Enter]
The temperature is too high.
Turn the thermostat down and wait
five minutes. Take the temperature
again and enter it here.
102.1 [Enter]
The temperature is acceptable.
Check it again in 15 minutes.
```

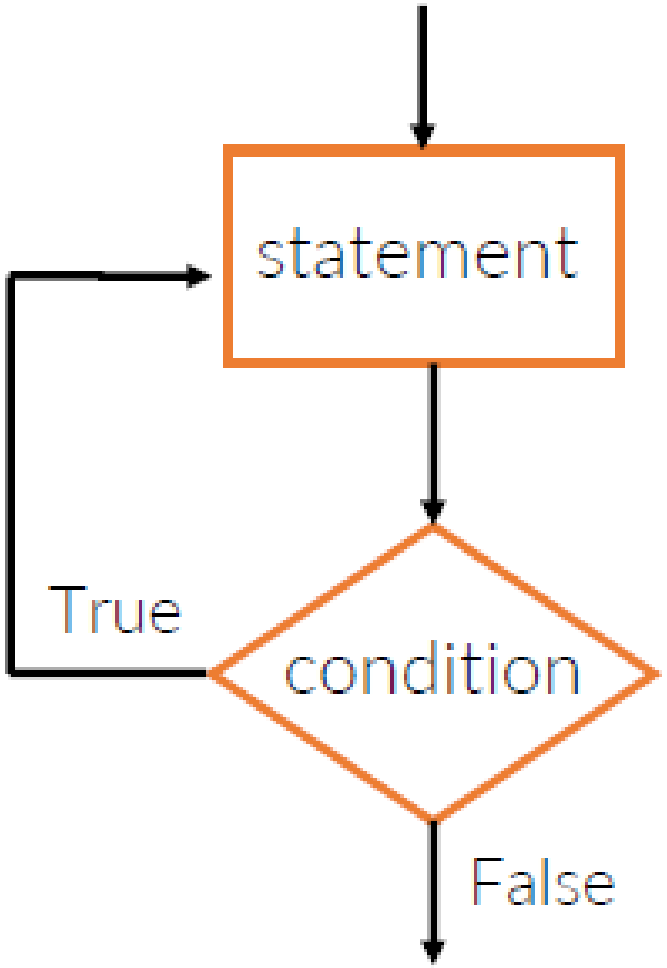
**Program Output (with Input Shown in Bold)**

```
Enter the substance's temperature.
102.1 [Enter]
The temperature is acceptable.
Check it again in 15 minutes.
```



# **DO-WHILE** Loop

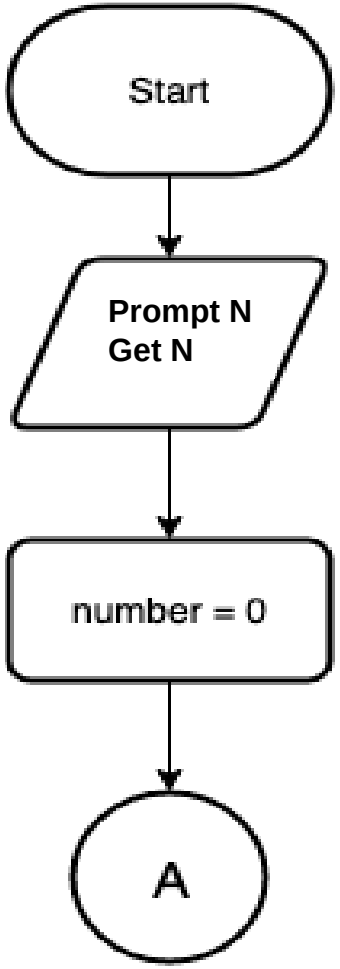
- The **Do-While** loop is a **posttest** loop. This means it performs an iteration before testing its condition.
- As a result, the Do-While loop **always performs at least one iteration**, even if its condition is false to begin with.

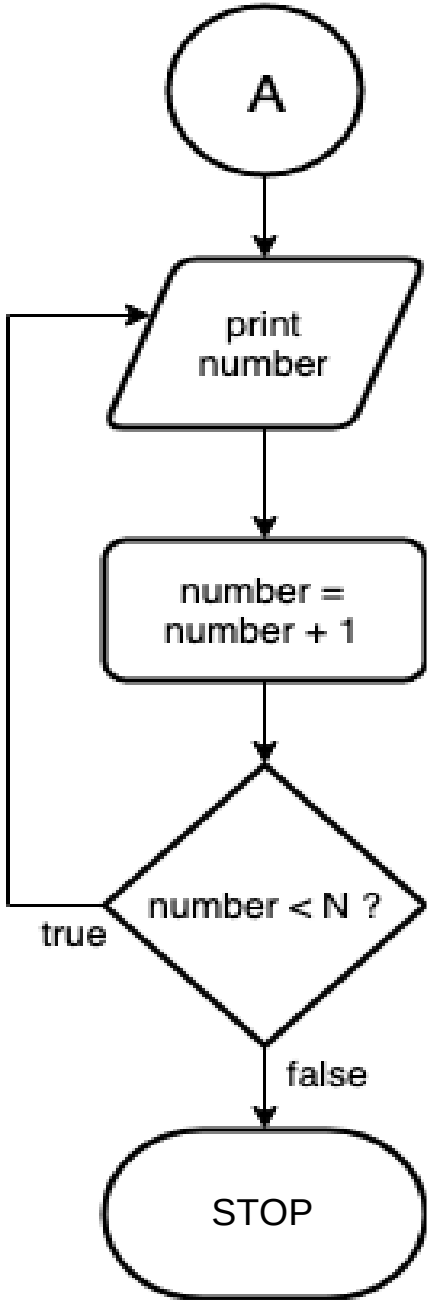


# **DO-WHILE** Loop

**Program output**
**(with Input Shown in Bold)**

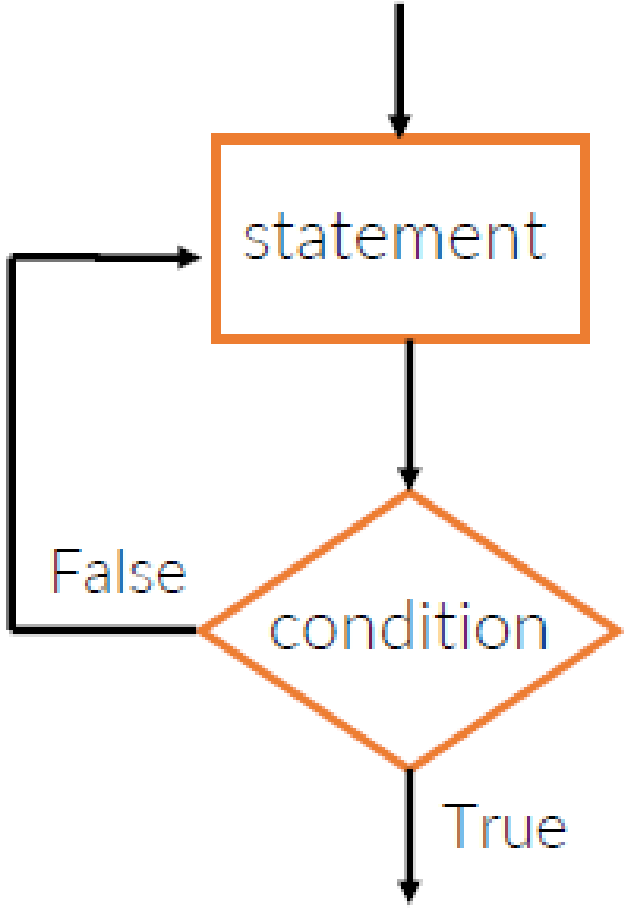
**10 [enter]**
0 1 2 3 4 5 6 7 8 9



# **DO-UNTIL** Loop

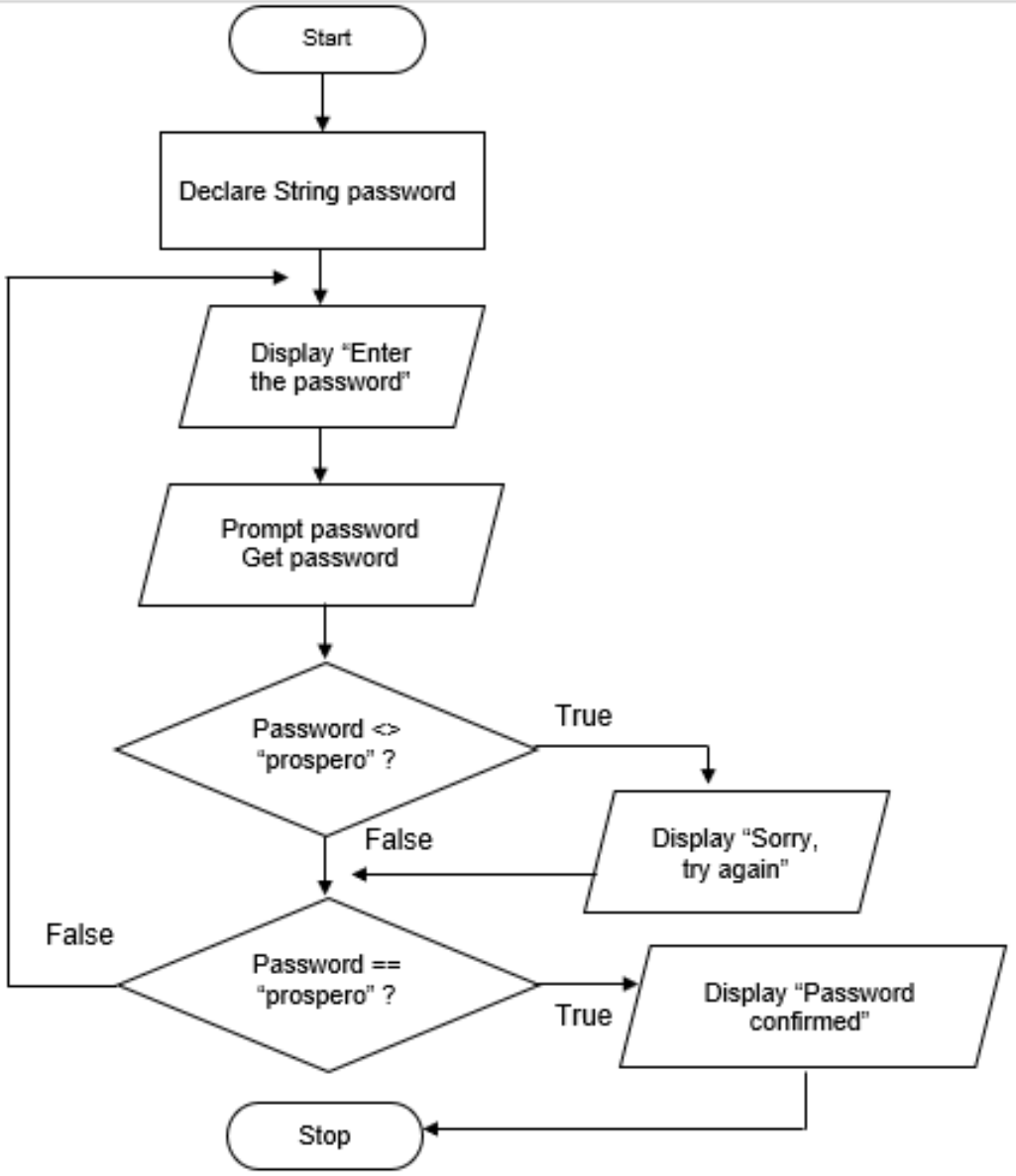
- Sometimes, however, it is more convenient to write a loop that iterates **until** a condition is **true**—that is, a loop that iterates as long as a condition is false, and then stops when the condition becomes true .



# **DO-UNTIL** Loop

**Program Output (with Input Shown in Bold)**

```
Enter the password.
ariel [Enter]
Sorry, try again.
Enter the password.
caliban [Enter]
Sorry, try again.
Enter the password.
prospero [Enter]
Password confirmed.
```



# Counter-Controlled Repetition

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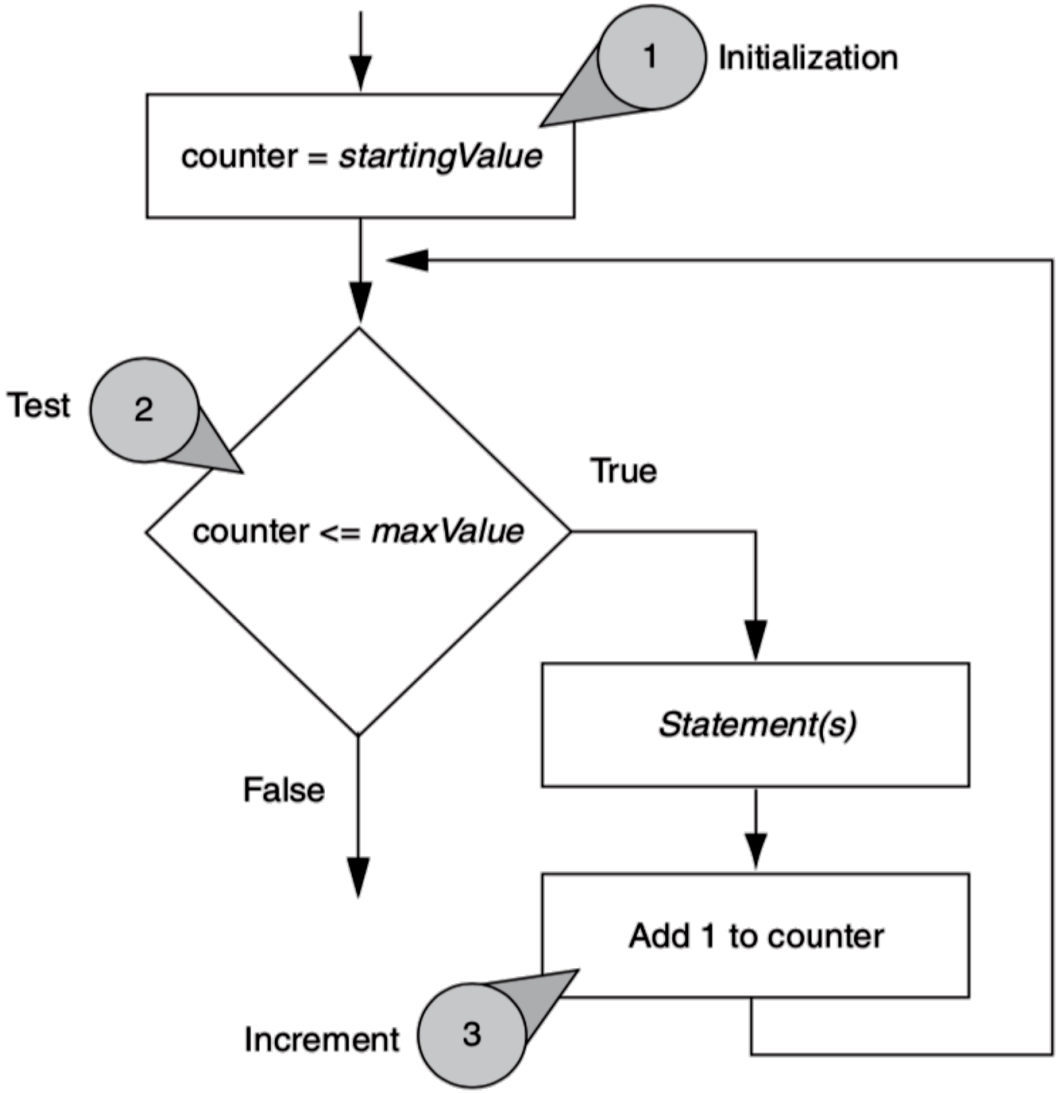
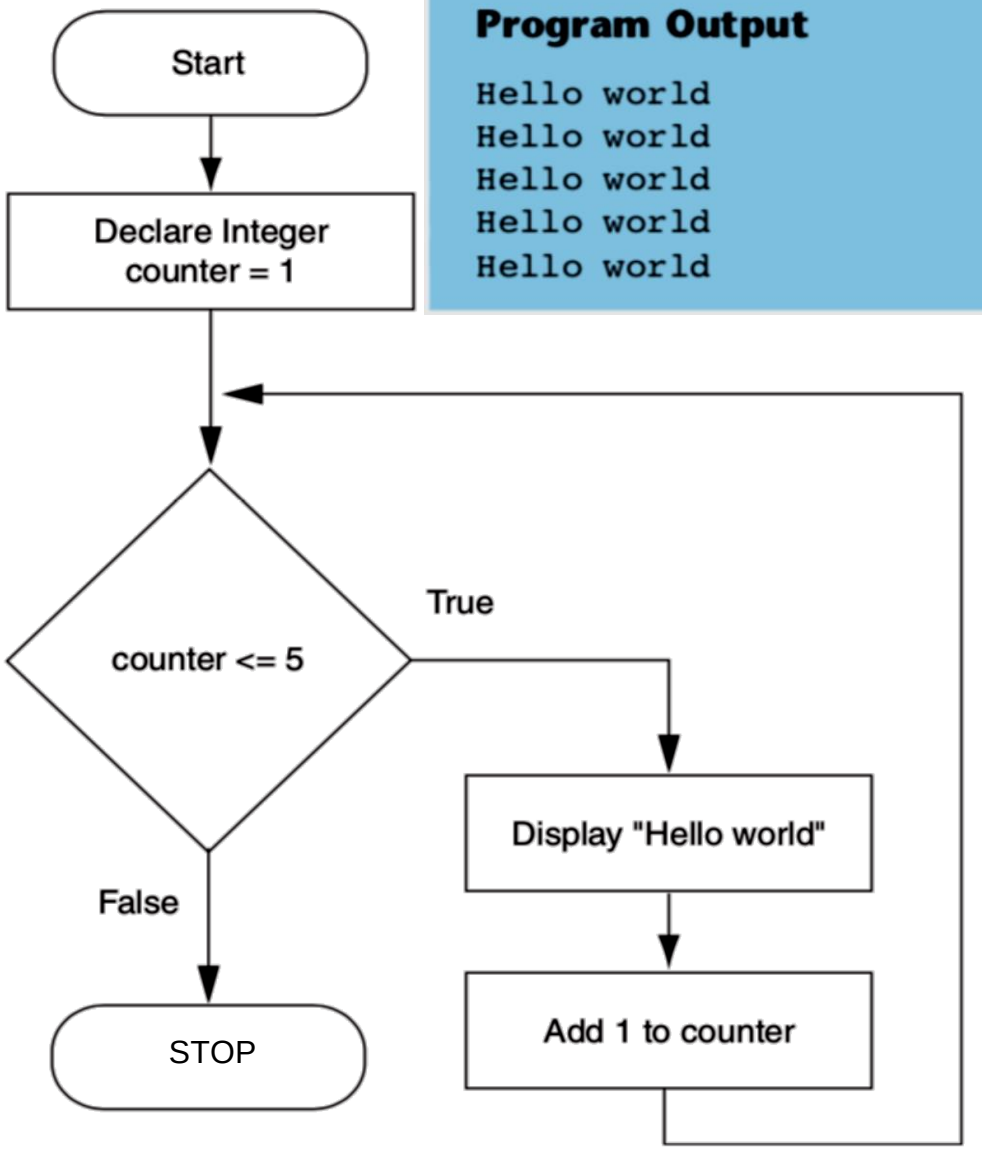
- Counter-controlled repetition is sometimes called **definite repetition** because we know in advance exactly how many times the loop will be executed.
- This is usually called the **For statement.**
- A loop control variable is used to count the number of repetitions
  1. **Initialization:** Loop control variable is set to an initial value before the while statement is reached
  2. **Testing:** Loop control variable is tested before the start of each loop repetition
  3. **Updating/Increment:** Loop control variable is updated (incremented / decremented) during each iteration

# Counter-Controlled Repetition




**Program Output**

```
Hello world
Hello world
Hello world
Hello world
Hello world
```

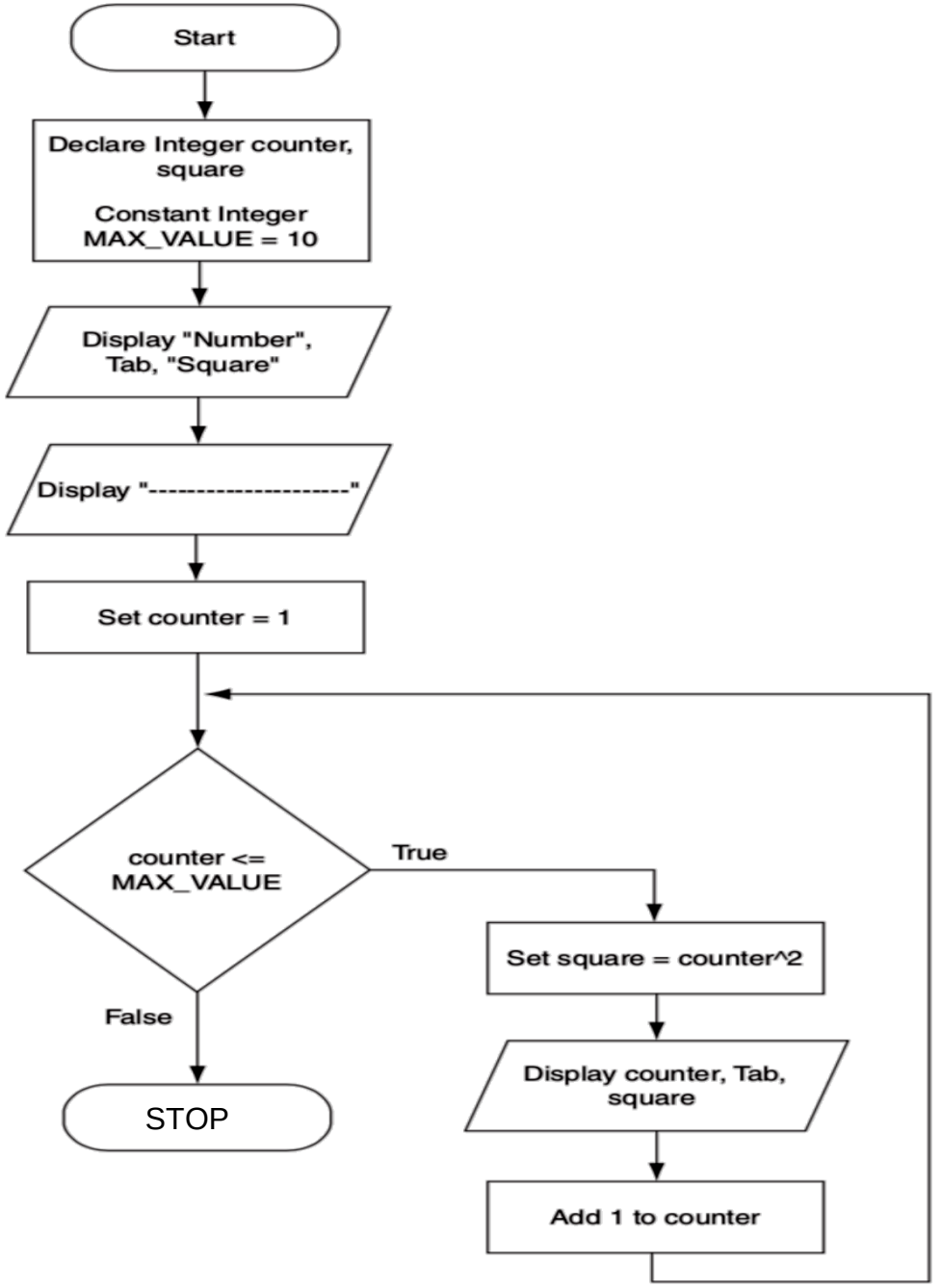
# **FOR** Statement

- In some situations, it is also helpful to use the counter variable in a calculation or other task within the body of the loop.
- For example, suppose you need to write a program that displays the numbers 1 through 10 and their squares.

# **FOR** Statement

**Program Output**

```
Number          Square
----------------------
   1               1
   2               4
   3               9
   4              16
   5              25
   6              36
   7              49
   8              64
   9              81
  10             100
```



# Practice 1

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- Design an algorithm in **flowchart** which displays the numbers 1 through the maximum value (user input) and their squares.
- Maximum value = 5

| Number | Square |
|---|---|
| 1 | 1 |
| 2 | 4 |
| 3 | 9 |
| 4 | 16 |
| 5 | 25 |

# Practice 2

- Design an algorithm **in flowchart** that print the following sequence of values

```
20 14 8 2 -4 -10
```

# Practice 3

- Design an algorithm **in flowchart** that print the following sequence of values

```
19 27 34 40 45
```

# Practice 4

- The factorial function is used frequently in probability problems. The factorial of a positive integer n (written n! and pronounced “n factorial”) is equal to the product of the positive integers from 1 to n. Draw a **flowchart** that evaluates the factorials of the integers from p to q (p and q are inputted by user). The screen dialogue should appear as follows:

```
1 5
1! = 1
2! = 2
3! = 6
4! = 24
5! = 120
```

```
3 8
3! = 6
4! = 24
5! = 120
6! = 720
7! = 5040
8! = 40320
```

# NEXT WEEK'S OUTLINE

1. Pseudocode of repetition control structure
2. Desk checking
3. Exercises

# REFERENCES


1. Gaddis, Tony, 2019, Starting out with programming logic & design, Fifth edition, Pearson Education, Inc.
2. Robertson, Lesley Anne, 2007, Simple Program Design A Step-by-Step Approach, Fith Edition, Thomson Learning, Inc.
3. Informatics study program slides, 2023, Fundamentals of Programming, Universitas Multimedia Nusantara.

# Visi

Menjadi Program Studi Strata Satu Informatika **unggulan** yang menghasilkan lulusan **berwawasan internasional** yang **kompeten** di bidang Ilmu Komputer (*Computer Science*), **berjiwa wirausaha** dan **berbudi pekerti luhur**.

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# Misi

1. Menyelenggarakan pembelajaran dengan teknologi dan kurikulum terbaik serta didukung tenaga pengajar profesional.
2. Melaksanakan kegiatan penelitian di bidang Informatika untuk memajukan ilmu dan teknologi Informatika.
3. Melaksanakan kegiatan pengabdian kepada masyarakat berbasis ilmu dan teknologi Informatika dalam rangka mengamalkan ilmu dan teknologi Informatika.