

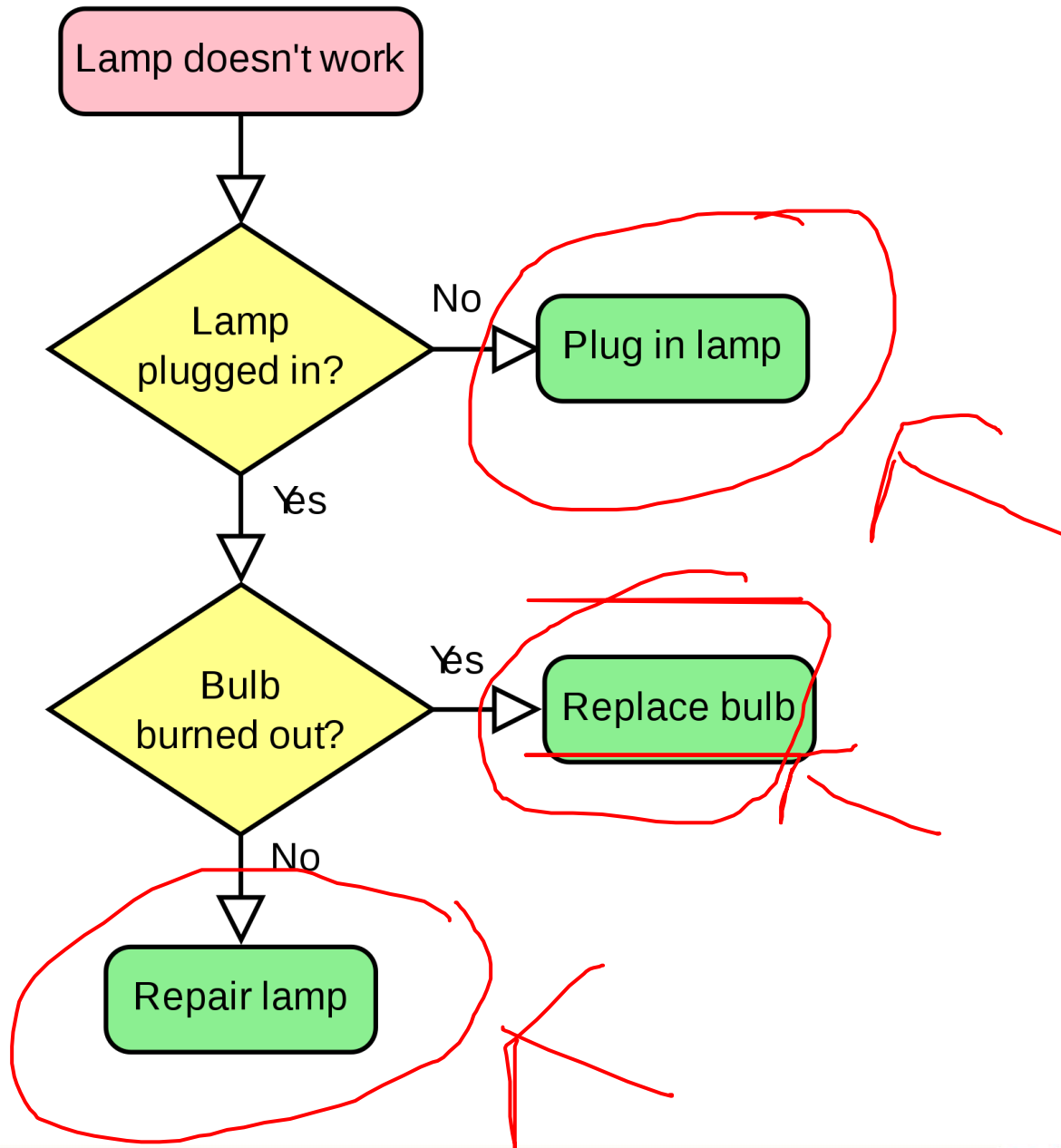
Introduction to Computer Science

*flowcharts and
pseudocodes*

Why do we need FC and Pseudocode?

*“**Flowcharts** are written with program flow from the top of a page to the bottom. Each command is placed in a box of the appropriate shape, and arrows are used to direct program flow.”*

*“**Pseudocode** is a method of describing computer algorithms using a combination of natural language and programming language.”*



What is a flow chart?








- A flowchart is a picture (graphical representation) of the problem solving process.
- A flowchart gives a step-by-step procedure for solving a problem.

Why we need flow charts?

- To specify the method of solving a problem.
- To plan the sequence of a computer program.
- To communicate ideas, solutions.




Elements of a flow chart

- Various symbols are used in drawing flow charts.
- They include,
 - Terminal symbol
 - Input / output symbol
 - Process symbol
 - Decision symbol
 - Flow lines

Symbol	Name
	Process
	input/output
	Decision
	Connector
	Predefined Process
	Terminal
	Flow Lines

Terminal symbol

- Oval shaped symbols are used to indicate the beginning and end of algorithms
- The ovals enclose the terms START and STOP, which indicate the beginning and end of the algorithms, respectively.

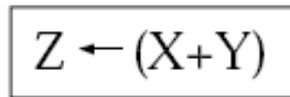
<u>SYMBOL</u>	<u>EXAMPLE</u>	
		START ACTION HERE.
TERMINAL		STOP ACTION HERE.

Process symbol

- Rectangles are used to indicate storage data and other mathematical operations
- The terms which are used to indicate storage of data include,
 - DEFINE, LET, INCREASE, ENHANCE, DECREASE, REDUCE, etc.
- The terms which indicate mathematical operations are those of COMPUTE, CALCULATE, etc.



PROCESSING



ADD THE VALUE CONTAINED
IN Y TO THE VALUE
CONTAINED IN X AND
PLACE THE RESULT IN Z

Input/output symbol

- Parallelograms are used to indicate the input and output operations.
- The terms which indicate the operation of input data are those of INPUT, GET, OBTAIN, FEED, etc.
- The terms which are used to indicate the operation of getting the results are those of OUTPUT, PRINT, WRITE, RESULT, etc.

Input/Output Symbol



INPUT/
OUTPUT



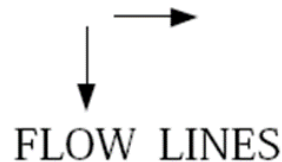
TAKE TWO VALUES FROM
AN EXTERNAL SOURCE AND
ASSIGN THEM TO X & Y ON
A TERMINAL/SCREEN



WRITE THE VALUES
CONTAINED IN X & Y ON
A TERMINAL/SCREEN

Flow lines

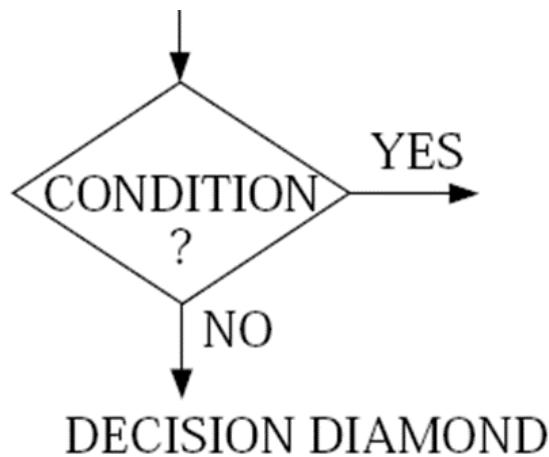
- Arrows are used to indicate paths, or alternate paths in order to repeat certain steps, in an algorithm.
- It shows the sequence in which the instructions are to be executed.
- The normal flow of flowchart is from top to bottom and left to right.
- As a good practice flow lines should not cross each other and such intersections should be avoided whenever possible.



THE ARROWS INDICATE THE
ROUTES FOR SYSTEMATIC
SOLUTION OF THE PROBLEM.

Decision symbol

- The decision symbol is used in a flowchart to indicate a point at which a decision has to be made and a branch to one of two or more alternative points is possible.
- Diamond shapes are used to test any logical conditions, and to make decisions.



IF CONDITION IS SATISFIED
THEN YES PATH IS TO BE
FOLLOWED OTHERWISE NO
ROUTE IS TO BE TAKEN.

Connector

- The connector represents entry from or exit to another part of the flowchart.
- A connector symbol is indicated by a circle and a letter or a digit is placed in the circle. This letter or digit indicates a link.
- A pair of such identically labelled connectors are used to indicate a continued flow in situations where flowcharts are complex or spread over more than one page

Connector



AN ENTRY IN THE FLOW CHART IS MADE AT THE CONNECTING POINT MARKED ①



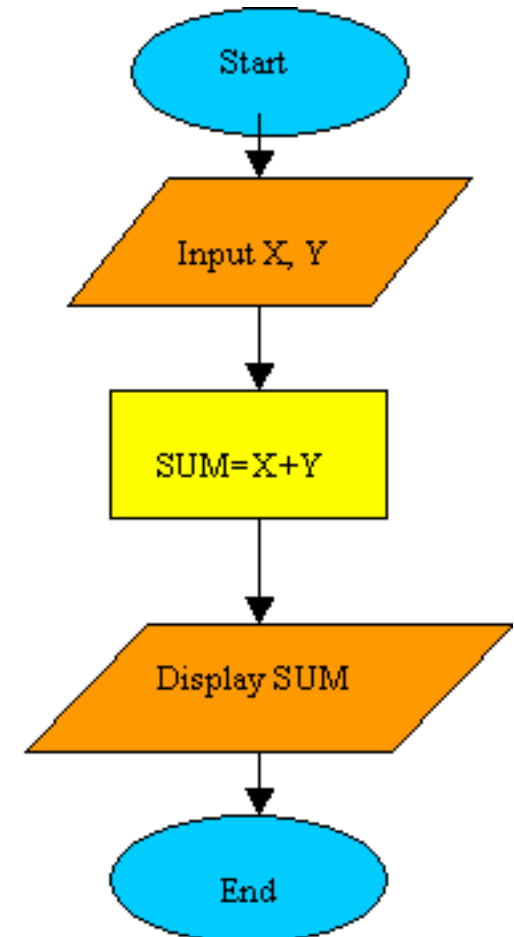
A TRANSFER OF PROBLEM SOLUTION IS MADE AT THE CONNECTOR POINT ② IN THE FLOW CHART.

Exercise 01

- Draw the flowchart to add two numbers.

Exercise 01

- Draw the flowchart to add two numbers.



Exercise 02

- Draw a flow chart that prints the perimeter and area of a rectangle given its height and width.

perimeter = $2 \times (\text{width} + \text{height})$

Area = width x height

Exercise 03

- Input a temperature in Celsius and convert it to Fahrenheit and display. Use the following equation to convert to Fahrenheit.

$$F = C \times \frac{9}{5} + 32$$

Exercise 04

- Draw a flow chart to take hours and minutes as input, and then outputs the total number of minutes.

E.g : (1 hour 30 minutes = 90 minutes).

Control Structures

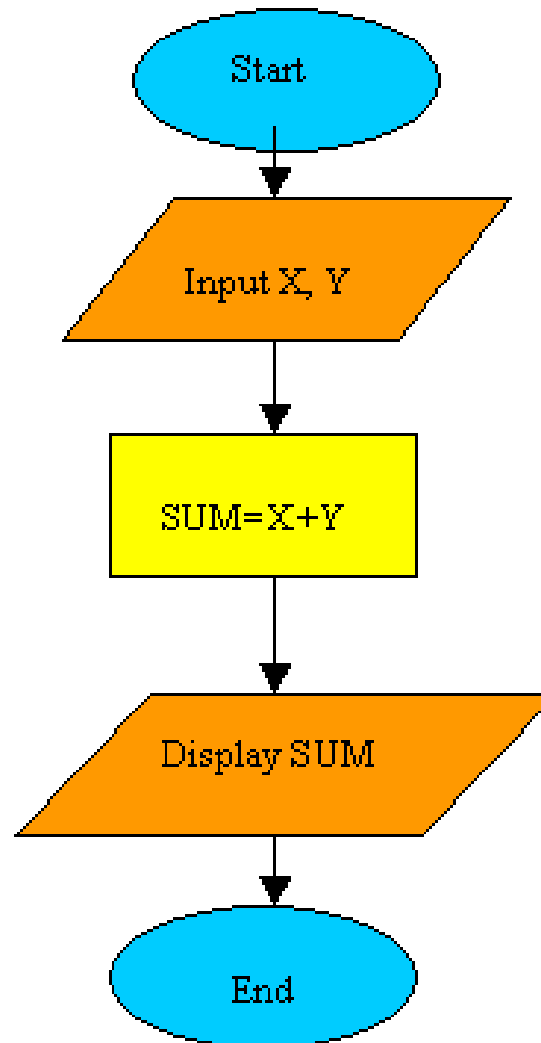
In programming there are 3 main Control Structures.

1. **Sequence** Control Structure
2. **Selection** Control Structure (Decision)
3. **Iteration** or Repetition Structure

1) Sequence Control Structure

- The statements in code are sequential (even when the sequences are run in parallel or concurrently).
- The programme statements are executing one after the other

Sequence Control Structure

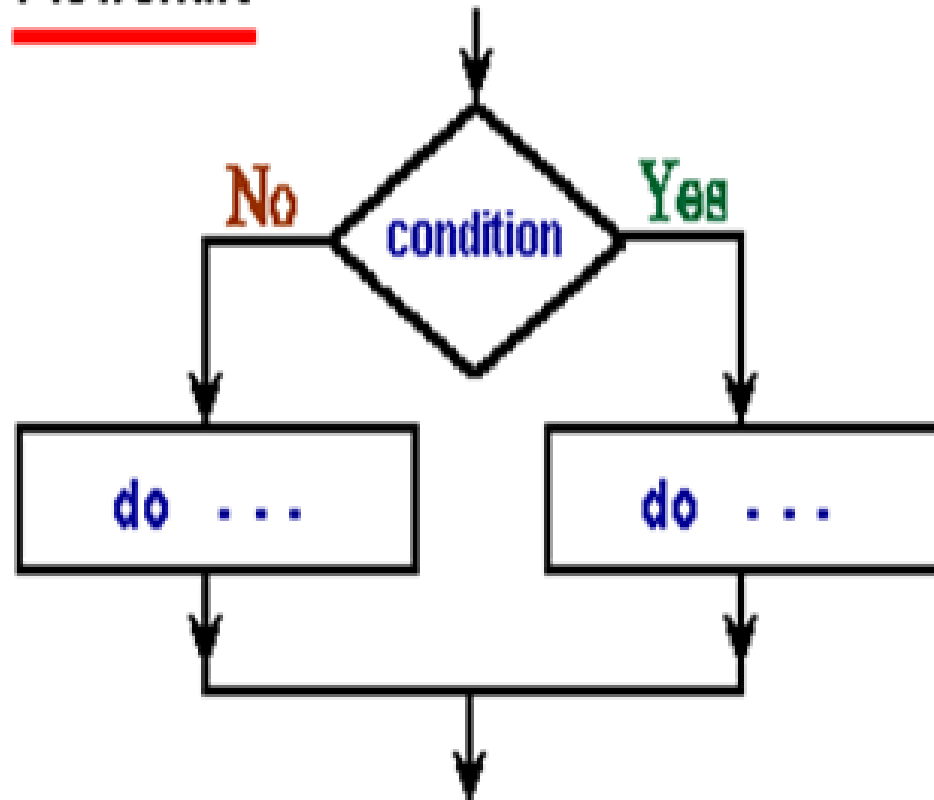


2) Selection Control Structure

- This means that program control may be transferred from one sequence to another sequence of instructions.
- In this structure it has options.
- Also program depends on conditions
- The general format of steps for flowcharting is as follows:
 - Perform the test of the condition.
 - If condition evaluates true branch to Yes steps.
 - If condition evaluates false branch to No steps.

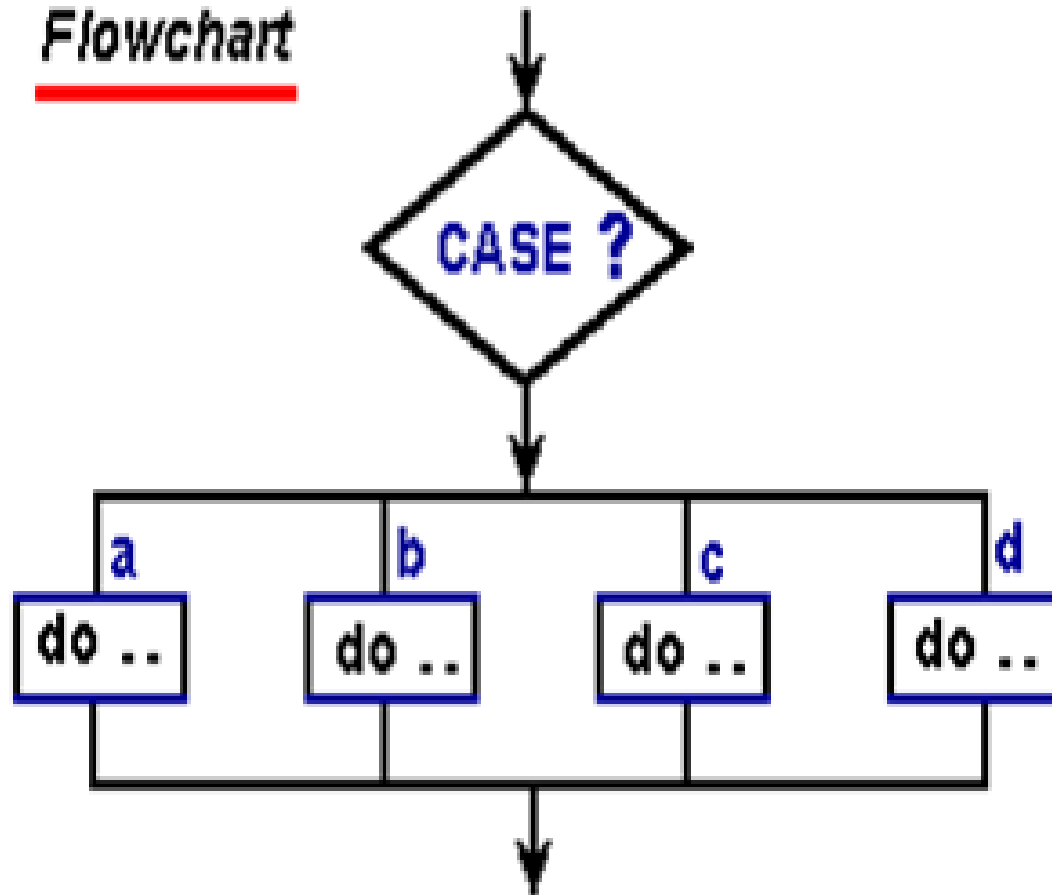
Selection Control Structure

Flowchart



Selection Control Structure

Flowchart



Exercise 05

- Draw a flowchart to input a mark a student has obtained and output the grade.

<u>Mark</u>	<u>Grade</u>
$\text{mark} < 40$	F
$40 \leq \text{mark} < 50$	C
$50 \leq \text{mark} < 70$	B
$70 \leq \text{mark}$	A

Exercise 06

- Draw a flow chart input a number and display whether it is positive, negative or zero.

Exercise 07

- Draw a flow chart input a number and display whether it is odd or even.

Exercise 08

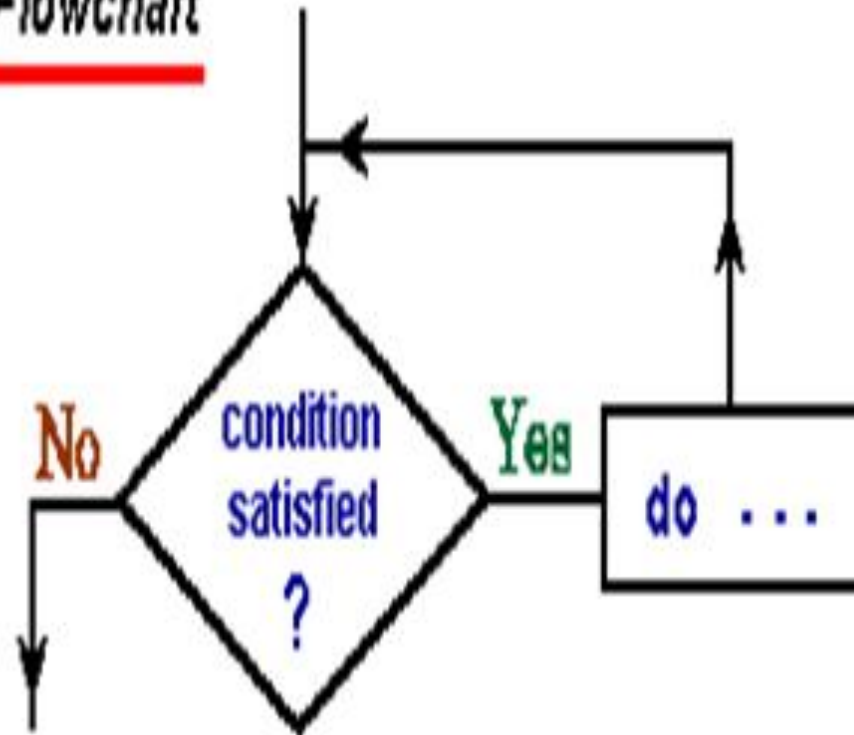
Draw a flow chart input two numbers and display the highest among them.

3) Iteration or Repetition Structure

- This means that, a given sequence is repeated.
- In this structure it repeats a group of steps in the flowchart.
- Also program statements are repeating over & over again until one condition becomes true or false.
- The loop process in general includes :
 - Setting and initialising a counter
 - execution of operations
 - testing the completion of operations
 - incrementing/decrementing the counter

Iteration or Repetition Structure

Flowchart



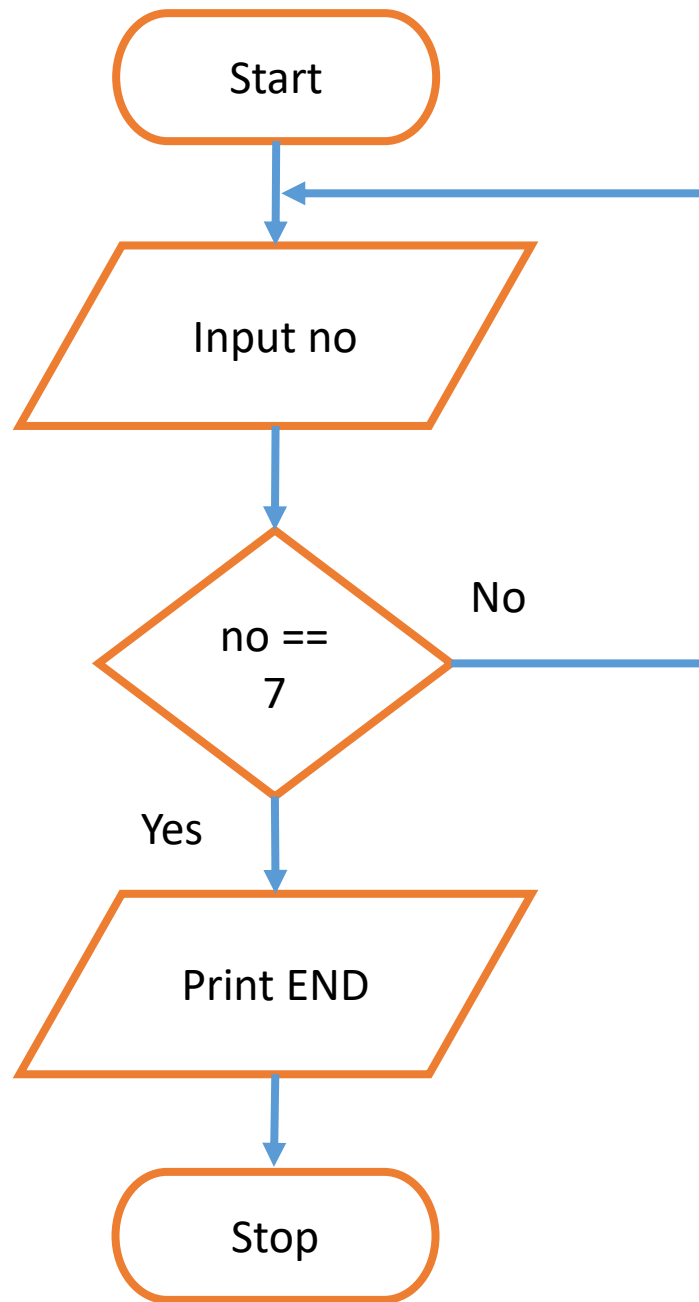
Example

- Check whether number read from keyboard is 7. If it is 7 then print END, else read another character.

This example shows the test which executes till a particular condition is satisfied.

The steps are :

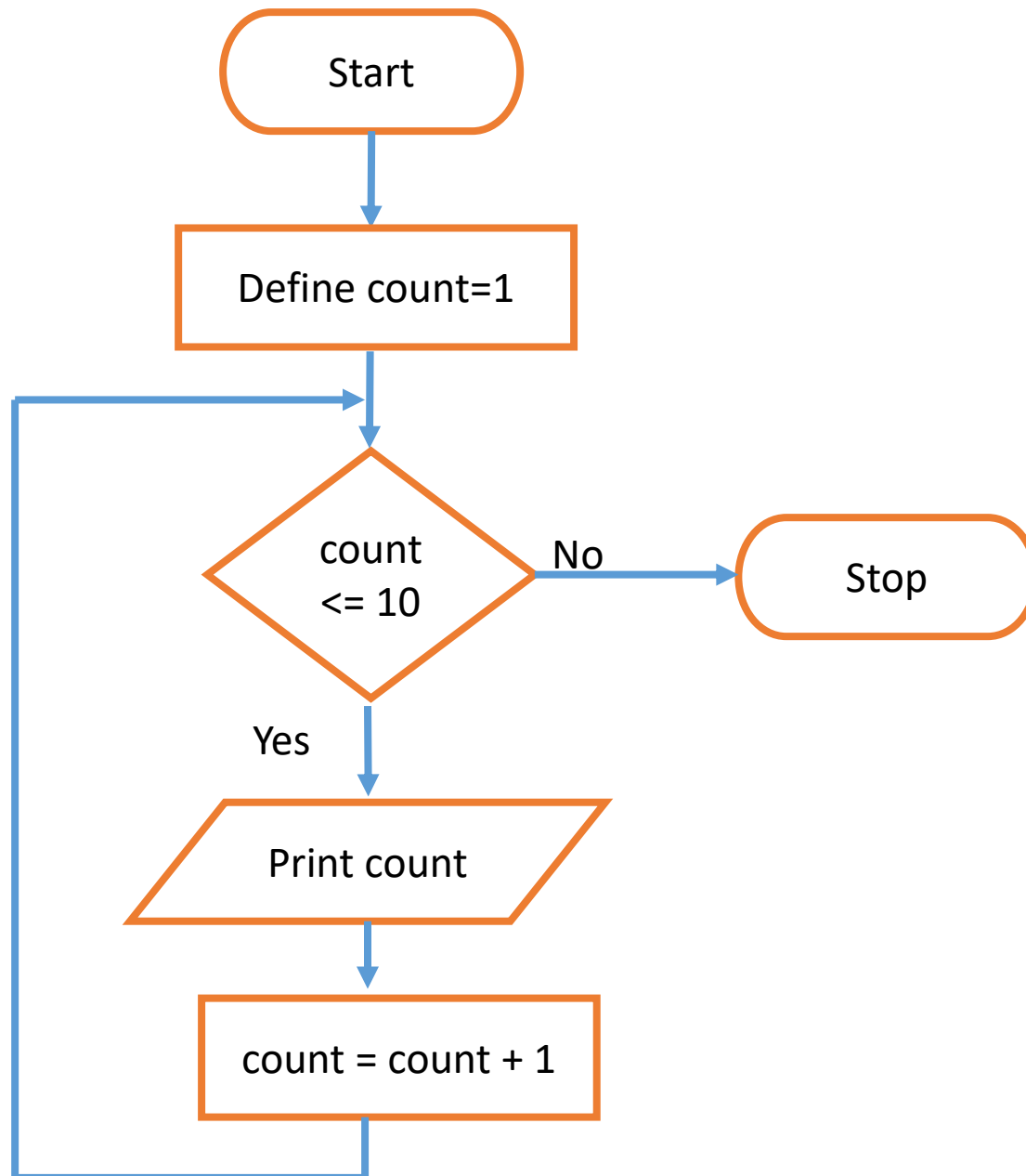
1. Start
2. Create variable no
3. Read no
4. Check if no = 7. If no go to step 3.
5. Print END
6. Stop



Exercise 09

- Draw a flowchart to display the following number sequence using a loop.

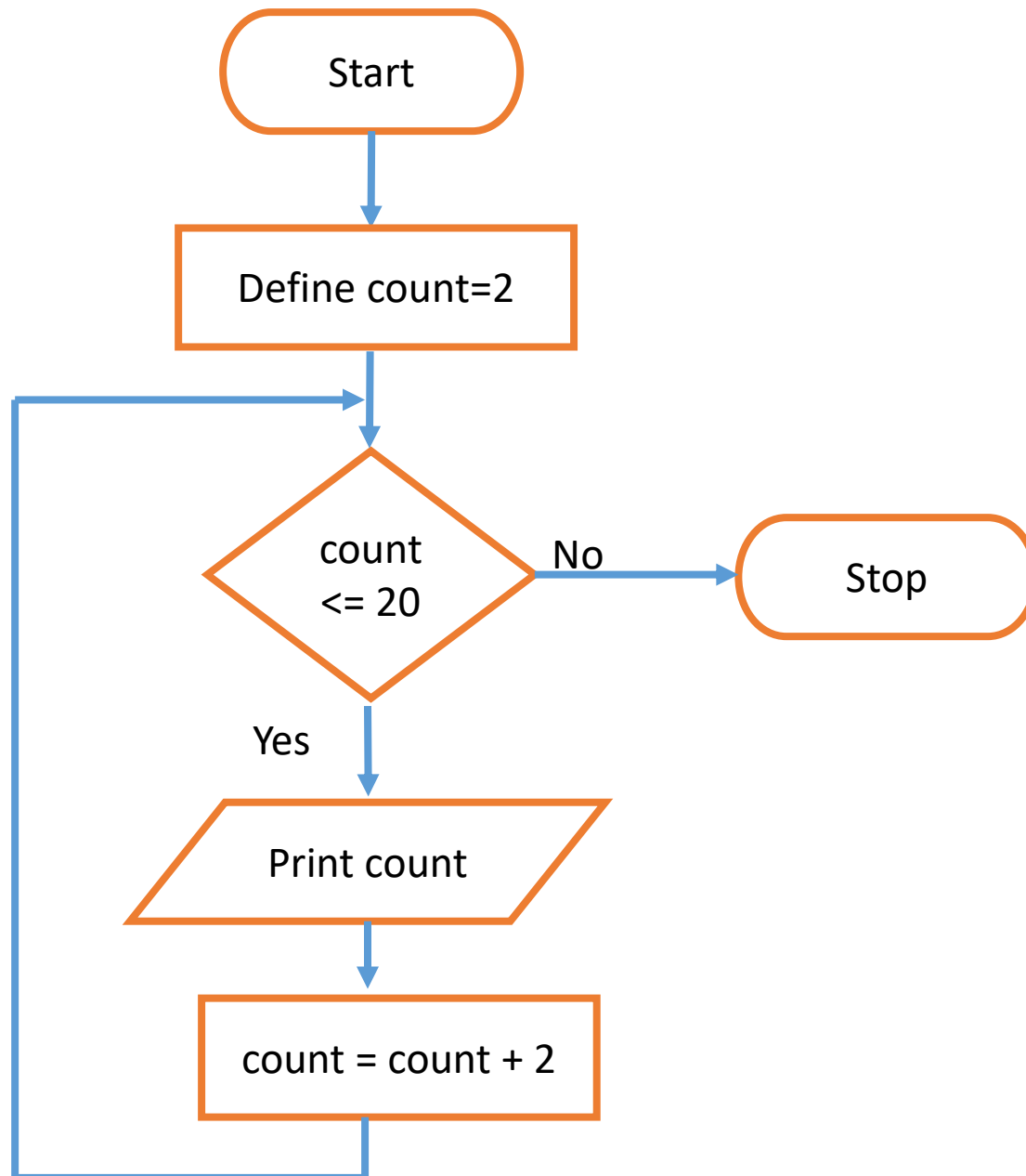
1 2 3 4 5 6 7 8 9 10



Exercise 10

- Draw a flowchart to display the following number sequence using a loop.

2 4 6 8 10 12 14 16 18 20



Exercise 11

- Draw a flowchart to input 10 numbers and display total and average.

Exercise 12

- Draw a flowchart to input 5 numbers and display no of odd and even numbers in the series.

Exercise 13

- Input a series of numbers which terminates by -1 and display the number of odd and even numbers in the number series.

Exercise 14

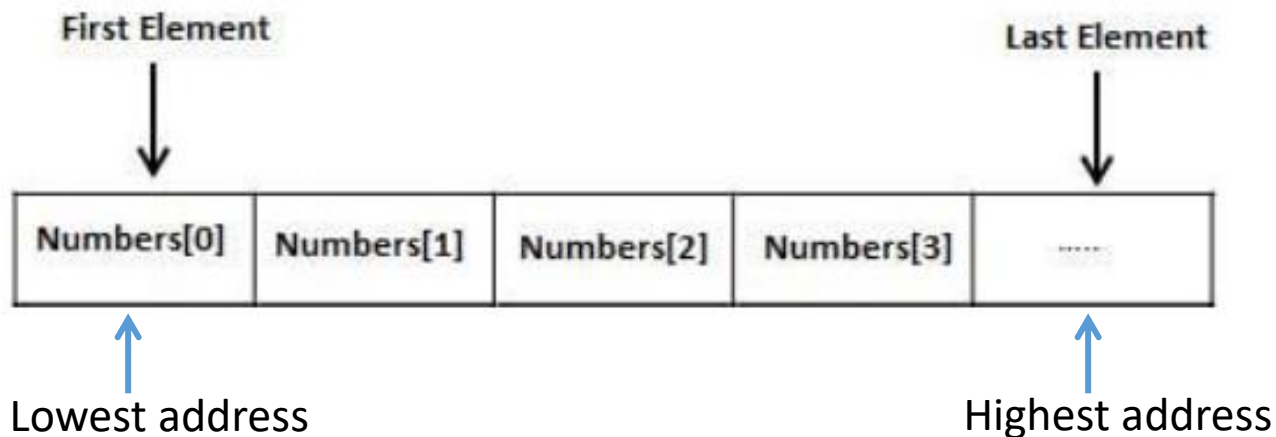
- Draw a flowchart to find the largest of three numbers A, B, and C.

Questions...

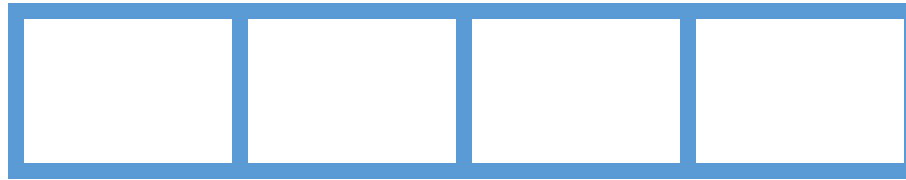
1. Draw a flow chart to calculate the gain on selling 10 items, when cost price(CP) and selling price(SP) of each item are given
2. Draw a flow chart to decide whether there is a gain or a loss, when cost price(CP) and selling price(SP) of 10 items are given

Array

- An array is a data structure which can store a fixed size sequential collection of elements of the same type.
- A specific element in an array is accessed by an index.
- All arrays consists of contiguous memory locations.



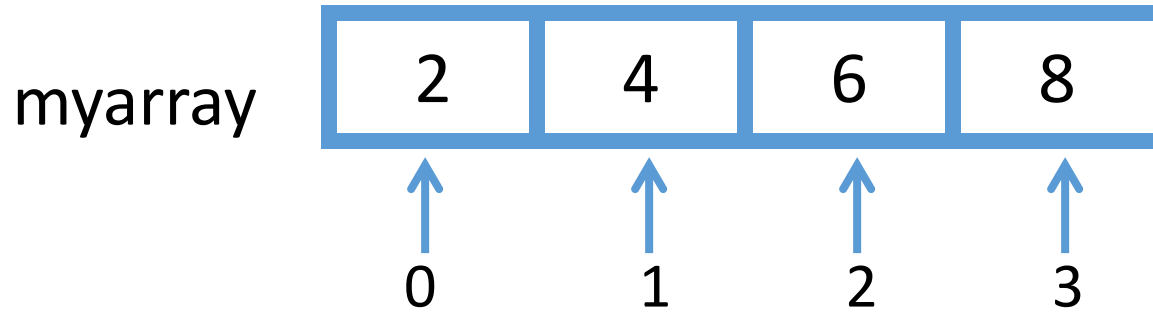
Index of an array



Index 0 1 2 3

- Index of the array start with 0 and the last index will be (array size - 1).

Example



Exercise 1

- Draw a flow chart to input 10 numbers into an array and output the sum (use one loop to input values and another to find the sum).

Exercise 2

- Draw a flow chart to input 5 values into an array. Display the maximum value (use one loop to input values and another to find the maximum).

Exercise 3

- Draw a flow chart to input 5 values into an array. Display the minimum value (use one loop to input values and another to find the minimum).

