

National University of Computer and Emerging Sciences



Lab Manual # 1

Programming Fundamentals

(Section BCS-1H1&1H2)

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Objectives

The objective of this lab is to introduce students with the concepts of algorithms, and pseudo code. After this lab, the students will be able to understand the basics of problem solving in programmatic context. Students will be representing solutions to different problems as pseudo code.

- **What is an algorithm?**

An algorithm is a procedure consisting of a finite set of instructions that provides a solution to a problem. In other words, an algorithm is a step-by-step procedure to solve a given problem. An algorithm can be translated into many programming languages. There are two ways of representing an algorithm. It includes pseudo code and flow chart.

- **What is a pseudo code?**

A pseudo code is a tool that can be used to write a preliminary plan for the development of a computer program. It is a generic way of describing an algorithm without the use of any specific programming language syntax. In fact, it serves as an English-like way to state an algorithm.

Important Notes

- In this lab you need to write algorithms in simple English language on your notebooks.
- You will be writing algorithms for sequential statements and conditional statements.

Example

Write a pseudo code for converting temperature entered by the user in centigrade to Fahrenheit.

```
BEGIN
  DISPLAY "Enter Centigrade:"
  INPUT centigrade_value
  CALCULATE Fahrenheit = (1.8*centigrade_value) + 32
  DISPLAY Fahrenheit
END
```

Question#1 (5 marks)

Write an algorithm that takes input in two variables **number1** and **number2**. Add these two numbers and store the result in **sum** variable. Print the sum.

Example Input:

Input 1: 3

Input 2: 7

Output:

Sum: 10

Question#2 (20 marks)

An assistant professor at NUCES-FAST created some programs/Algorithms for solving a number of easy problems. In this activity, your primary job is to analyze each of the Algorithm and identify the problem it solves.

To make the task easier, a list of possible problems being solved is also specified along with the Algorithms. You must be careful while analyzing each of the Algorithm as more than one Algorithm might solve the same problem and some of the problems might not be solved by any of the given Algorithms.

Algorithm No 1	Algorithm No 2
10 CR R,A 20 IN R 30 $A = 3.1415 * R * R$ 40 OUT A	10 CR FT, OT, FH,AMT 20 IN FT, OT, FH 30 $AMT = 5000 * FT + 1000 * OT + 500 * FH$ 40 OUT AMT
Algorithm No 3	Algorithm No 4
10 CR X,Y 20 IN X 30 $Y = 9/5 * X + 32$ 40 OUT Y	10 CR x, y, ANS 20 IN x, y 30 $ANS = x * y$ 40 OUT ANS
Algorithm No 5	Algorithm No 6
10 CR X, Y, TMP 20 IN X, Y 30 IF (X > Y) THEN 40 TMP = X 50 X = Y 60 Y = TMP 70 END IF 80 OUT X, Y	10 CR F, C 20 IN F 30 $C = (5 * F - 160) / 9$ 40 OUT C

Algorithm No 7		Algorithm No 8	
10	CR X	10	CR R,A, PI
20	IN X	20	IN R
30	X = 1.8*X + 32	30	PI = 2*3.1415
40	OUT X	30	A = PI*R
		40	OUT A

The Problem list includes

- i) Compute Area of a circle using its radius. Formula for calculating area of a circle is πr^2
- ii) Calculate Area of a rectangle using the width W and Breadth B where **Area = W*B**
- iii) Read two numbers and print the numbers in ascending order
- iv) Calculate the total amount present in an ATM machine using the count of 5000, 1000 and 500 rupee note available in the machine
- v) Compute the velocity, V_f , of an object after t seconds using its initial velocity, V_i , and acceleration, a . The formula that relates these velocities and acceleration is $V_f = V_i + at$
- vi) Compute circumference of a circle where it's formula is $2\pi r$
- vii) Read two numbers and print the numbers in descending order.
- viii) Compute total area of all walls and the roof of a cube shaped room.
- ix) Convert temperature from Fahrenheit scale to Celsius scale. The formula that relate the two scales is **$C = 9/5 F + 32$**
- x) Convert temperature from Celsius to Fahrenheit scale.

Question#3 (5 marks)

Write an algorithm that takes as input a list of numbers from the user and then a number to search within it.

Example Input:

List: 12, 17, 3, 44, 77, 2, 1

Number to search: 2

Output: Number 2 exists in the list

Number to search: 21

Output: Number 21 does not exist in the list

Language ALGORITHM 2.0 (Reference)

A summary of instructions of ALGORITHM 2.0 is given in the following table.

Instruction	Purpose
CR {List of names}	Create a list of variables
Expressions	<p>Expression can be arithmetic or logical but each expressions evaluates to a number with logical expressions having value of 0 if false and 1 if true.</p> <p>Expressions can be formed using Location Names, numbers, arithmetic operators {+, -, *, /, DIV, MOD}, and relational operators {<, <=, >, >=, !=, ==} and parentheses</p>
Assignment operation =	Operation to assign a value to a Location
IN {List of Location_names}	Read multiple values from the input device and place these values at locations specified by the location names
OUT {List of Expressions}	Display the values of multiple expressions on the output device in the given order.
IF (Expression) THEN ... ENDIF	Conditional execution of instructions between THEN and END IF . Instructions will be executed only if the value of expression is non- zero.
IF (Expression) THEN ... ELSE ... ENDIF	Conditional execution of instructions between THEN and ELSE or ELSE and END IF . Instructions written between THEN and ELSE will be executed if the value of expression is non-zero and the instructions between ELSE and ENDIF will be executed otherwise