# National University of Computer and Emerging Sciences


# Programming Fundamentals CS188
# Laboratory Manual

| | |
|---|---|
| Course Instructor | Mirza Mubasher Baig |
| Lab Instructor(s) | Samia Akhter & Faraz Yousaf |
| Section | BDS-1A1 & A2 |
| Semester | FALL 2021 |

**FAST School of Computing**
**Department of Software Engineering**
**FAST-NU, Lahore, Pakistan**

# National University of Computer and Emerging Sciences, Lahore Campus

| Lab No 1 | | | |
|---|---|---|---|
| Course Name: | Programming Fundamentals | Course Code: | CS188 |
| Program: | BS(DS) | Semester: | Fall 2021 |
| Duration: | 2.5 hours | Total Points: | 100 |
| Lab Date: | Thursday, 23 September 2021 | Weight | 3% |
| Section: | BDS-1C | Page(s): | 5 |

**Instruction/Notes:** **Cheating during the lab will result in negative marks**

**Topics Covered:** Computational Problem Solving

In this lab we will mainly perform two activities

1. Identify the purpose of a given Algorithm
2. Writing an Algorithm for solving a given problems

The programs considered in this lab will only involve the following notions

- Declare variables and use a variable to store a value and access it later.
- Write arithmetic and logical expression involving variables and constants.
- Control precedence of operations of an expressions using parenthesis.
- Input / Output of values.
- Use **IF-THEN** and **IF-THEN-ELSE** structure to attain conditional execution of instructions.

## First Activity (Marks 30)

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

| 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 $\pi r^2$
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.

## Second Activity

### PART a) (Marks 40)

By now you might have discovered that there are at least **3** problems without a corresponding Algorithm to solve it. In this activity, you are required to write Algorithms to solve each of the unsolved problems. You must submit the typed Algorithm on the google-classroom.

## Part b (Marks 15 + 15)

**Problem No 1:**

The total number of students in a class are **N** out of which **B percent** are boys. If 30% of the total students secured a grade 'B' out of which 40% are boys. Write a program in Algorithm 2.0 that

1. Input the value of N and B
2. Calculates the total number of boys and girls in the class
3. Calculates the number of boys and girls who got a B grade.
4. Output the computed information.

**Problem No 2:**

A common task performed by a cash clerk working at a famous store to compute the amount of money to be returned to the customer. The cash clerk knows the **total bill** and **amount paid** by the user and he then computes the **amount to be returned** and number of **notes/coins** of each type to be given back to the customer.

In this problem your job is to write a program in Algorithm 2.0 that will take as input the total bill and the amount rendered/paid by the customer. The program should then print the amount to be given back to the customer along with the quantity of each type of notes/coins.

The program must compute the minimum number of notes of each type to make the job of clerk easier.

Further, you must assume that the notes of Rs. 5000, 1000, 500, 100, 50, 20, and 10, and coins of amount Rs. 5, 2 and 1 are used in Pakistan.

For example, when user enter a number bill amount **425** and cash given by customer as Rs. **1000** as the two inputs the program must display the following information in an easy to read format on screen.

| | | |
|---|---|---|
| Amount: | 575 | |
| | 500: | 1 |
| | 50: | 1 |
| | 20: | 1 |
| | 5: | 1 |

**The program must also display a warning message on screen if amount paid is less than the total bill**

**HINTS:** You might find the **DIV** and **MOD** operations useful for solving this problem

Remember that **a mod b** is the remainder when **a** is divided by **b** and **a DIV b** given only the integer part of the answer when **a** is divided by **b.**

If you are not already registered on the online classroom then get registered using the following class code for registration.
**Class Code: trdcyed**

## GOOD LUCK

# 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** | 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.<br><br>Expressions can be formed using Location Names, numbers, arithmetic operators {+, -, *, /, **DIV**, **MOD**}, and relational operators {<, <=, >, >=, !=, ==} and parentheses |
| **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**<br>**…**<br><br>**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**<br>**…**<br><br>**ELSE**<br>**…**<br><br>**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 |