Programming Fundamentals

Week 03 - Lab Manual

Important Guidelines

- Complete all tasks and push them to GitHub before the deadline. Late submissions will incur a penalty of **10%** of the total marks for each day past the deadline (this rule applies to all upcoming labs).
- Any use of AI tools to generate answers or code, or copying code from others, will result in a zero for that submission and may negatively affect overall performance, potentially leading to an F grade in the course, including both theory and lab components. Copying your own previously written code is allowed.

Introduction

Welcome to your favorite programming Lab. In this lab manual, we wil work together to learn and implement new programming concepts

Skills to be learned:

- Identifying the Variables and Datatypes for any given problem.
- Write a complete program that converts input into the required output.

Let's do some coding.

Skill: Converting one type of data into other type

Introduction

Variables are the containers that are used to store different values. Recall the constraints of having valid variable names from the class.

- The names cannot have spaces
- The names cannot start with Numbers
- The names cannot have any special Characters (e.g.! @#$%^&*(){})

Data types tell the compiler what type of data you want to store in memory and how much space should be allocated for it. They also determine what kind of operations can be performed on that data.

The following table lists the data types that are used to store different values.

Datatype	Description
Int	This data type is used to store integer values (whole numbers without decimal points), such as 0, 7, 19, 29, 3999, -5, -1999.

Skill: Identifying the Variables and Datatypes for any given problem.

Float	This data type is used to store floating-point (decimal) values, such as 3.14, 2.5, -0.75, and 10.0.
Char	This data type is used to store a single character, such as 'A', 'b', '7', or '#'.
String	This data type is used to store a sequence of characters (text), such as "Hello", "Laeeq", "C++ Programming", or "12345".

Examples:

Valid Example	Invalid Examples	Description

`#include<iostream>`
`using namespace std;`
`main()`
`{`
`  int number;`
`}`
	`#include<iostream>`
	`using namespace std;`
	`main()`
	`{`
	`  Int number;`
	`}`
		C++ is a case-sensitive language. **Int and int** are two different words and represent different things.

`#include<iostream>`
`using namespace std;`
`main()`
`{`
`  int roll_no;`
`}`
	`#include<iostream>`
	`using namespace std;`
	`main()`
	`{`
	`  int roll no;`
	`}`
		Spaces are not allowed in the variable names.

`#include<iostream>`
`using namespace std;`
`main()`
`{`
`  string session2023;`
`}`
	`#include<iostream>`
	`using namespace std;`
	`main()`
	`{`
	`  string 2023session;`
	`}`
		The variable names **cannot start with numbers**.

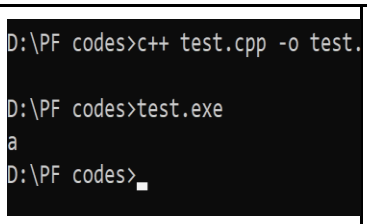
Following are a few examples of how to declare, initialize, and assign values for different types of variables.		

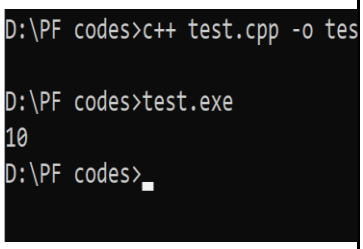
`#include<iostream>`
`using namespace std;`
`main()`
`{`
`  string name = "irzam";`
`  cout << name;`
`}`
	`D:\PF codes>c++ test.cpp -o test.e`
	
	`D:\PF codes>test.exe`
	`irzam`
	`D:\PF codes>`
		Declaring and initializing a string type variable

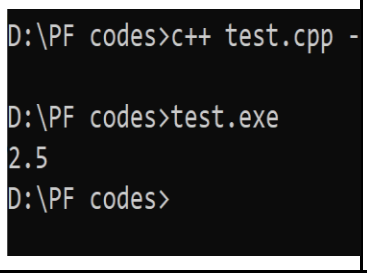
Skill: Identifying the Variables and Datatypes for any given problem.

Programming Fundamentals

Week 03 - Lab Manual

`#include<iostream>`
`using namespace std;`
`main()`
`{`
`  char alphabet = 'a';`
`  cout << alphabet;`
`}`
		Declaring and initializing a character type variable

`#include<iostream>`
`using namespace std;`
`main()`
`{`
`  int number;`
`  number = 10;`
`  cout << number;`
`}`
		Declaring and printing an int type variable

`#include<iostream>`
`using namespace std;`
`main()`
`{`
`  float number = 2.5;`
`  cout << number;`
`}`
		Declaring and printing a float type variable

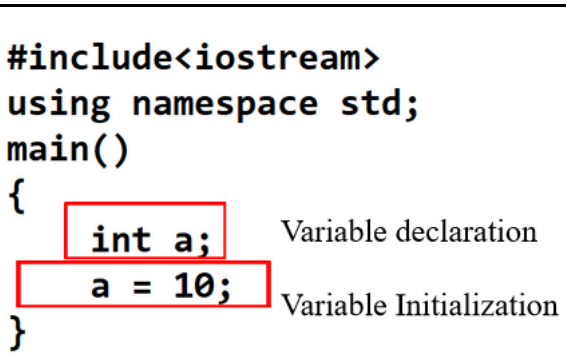
Skill: Identifying the Variables and Datatypes for any given problem.

Programming Fundamentals

Week 03 - Lab Manual

Skill: Write a complete program that converts input into the required output

In class, you have studied variable declaration that is used to declare a variable of fixed size in memory. Additionally, the assignment operator is used to assign a value to the declared variable.

Look at the attached example for recalling these concepts.	

Tasks

- Declare a string-type variable and assign it your name and print it on the screen.
- Declare an integer type variable and assign it your roll number and print it on the console screen
- Initialize a float type variable with your aggregate value and print it on the console screen.
- Initialize a character type variable with your section and print it on the screen.
- Now, write a program where you take all these values and print them on the screen like below.

Now, let's learn to take input from the user.

consider the following problem.

Task01(WP): Write a program that **takes a number from the user (console screen)** in dollars and converts it into rupees. 1 Dollar = 282 rupees

Let's code this one out.
We need the following: • A variable for storing the value of one dollar • A variable for storing the value of value entered by the user • A variable to store the converted value in rupees

Skill: Write a complete program that converts input into the required output

- An expression that converts the dollars into rupees and stores it into the third variable

```
#include <iostream>
using namespace std;

main()
{

  int dollarPrice = 282;
  int dollars;
  cout<<"Enter amount in dollars : ";
  cin>>dollars;
  int rupees;
  rupees = dollars * dollarPrice;

  cout<<"Dollars "<<dollars<<" Into Rupees are "<<rupees;

}
```

```
D:\PF-Semester1>p1.exe
Enter amount in dollars : 25
Dollars 25 Into Rupees are 7050
D:\PF-Semester1>
```

Great Work Students! You have added another skill to your skillset

Conclusion

Variable	Variables are the containers that are used to store different values
Data Type	Datatype defines the label according to the type of data that is stored in the variables.
cin >> dollars;	It is used to take input from the console.

Task 01(CL): Write a C++ program that inputs from the user his name, roll number, aggregate, and section and prints it on screen.

Don't forget to test your code using at least the test cases given below.

Skill: Write a complete program that converts input into the required output

Programming Fundamentals

Week 03 - Lab Manual

Test Cases:

```
Enter your Name:
ahad
Enter your Roll Number:
99
Enter your Aggregate:
56.9
Enter your Section:
F

--- Student Info ---
Name: ahad
Roll No: 99
Aggregate: 56.9
Section: F
```

```
Enter your Name:
Azyan
Enter your Roll Number:
55
Enter your Aggregate:
20.7
Enter your Section:
A

--- Student Info ---
Name: Azyan
Roll No: 55
Aggregate: 20.7
Section: A
```

```
Enter your Name:
Haram
Enter your Roll Number:
7
Enter your Aggregate:
96
Enter your Section:
N

--- Student Info ---
Name: Haram
Roll No: 7
Aggregate: 96
Section: N
```

Task 02(OP): Write a C++ program that converts the weights from lbs. (Pounds) to kgs (Kilograms). 1lb = 0.45 Kgs

Note: The user enters weights in lbs. and the program prints it in kgs.

Test Cases:

```
Enter weight in pounds: 60
60 pounds is equal to 27 kilograms
```

```
Enter weight in pounds: 4
4 pounds is equal to 1.8 kilograms
```

Skill: Write a complete program that converts input into the required output

```
Enter weight in pounds: 156
156 pounds is equal to 70.2 kilograms
```

Task 03(OP): Write a C++ program that takes the length and width of the rectangle from the user and prints its area. Area = length * width

Test Cases:

```
Enter the length of the rectangle: 78.6
Enter the width of the rectangle: 45.34
The area of the rectangle is = 3563.72
```

```
Enter the length of the rectangle: 3.456
Enter the width of the rectangle: 3.897
The area of the rectangle is = 13.468
```

Task 04(CP): Write a C++ program that takes charge (Q) and time (t) as input from the user and prints the current (I) on the console. Current(I) = Charge (Q)/Time(t)

Test Cases:

```
Enter the charge (Q) in Coulombs: 87
Enter the time (t) in seconds: 45
The current (I) is = 1.93333 Amperes
```

```
Enter the charge (Q) in Coulombs: 3
Enter the time (t) in seconds: 56
The current (I) is = 0.0535714 Amperes
```

Task 05(CP): ECAT Aggregate Calculator.

Write a C++ program that takes the name, matric (out of 1100), intermediate (out of 550), and Ecat (out of 400) marks of the student and print their aggregate score for UET. Ecat = 50% & intermediate = 40% & Matric = 10%

Test Cases:

```
Enter the student's name: Rehman
Enter matriculation marks (out of 1100): 986
Enter intermediate marks (out of 550): 456
Enter ECAT Marks (out of 400): 256
Aggregate score for Rehman is74.1273%
```

```
Enter the student's name: alia
Enter matriculation marks (out of 1100): 1046
Enter intermediate marks (out of 550): 545
Enter ECAT Marks (out of 400): 200
Aggregate score for alia is74.1455%
```

Skill: Write a complete program that converts input into the required output

Programming Fundamentals

Week 03 - Lab Manual

Task 06(OP): Write a C++ program that takes the megabytes from the user and converts them into bits and prints the value on the screen. 1MB = 1024 Kb & 1KB = 1024 Bytes & 1Bytes = 8 Bits

Test Cases:

```
Enter the size in megabytes (MB): 3
3 MB is equivalent to 2.51658e+007 bits
```

```
Enter the size in megabytes (MB): 5000
5000 MB is equivalent to 4.1943e+010 bits
```

Task 07(OP): You are developing a C++ program for a time-tracking application. The program needs to take an integer input representing hours and convert it to seconds to accurately record the time in seconds.

Test Cases:

```
Enter the number of hours: 4
4 is equivalent to 14400 seconds
```

```
Enter the number of hours: 45
45 is equivalent to 162000 seconds
```

Task 08(OP): You are developing a C++ program for an electrical engineering application. The program needs to calculate power (in watts) given voltage (in volts) and current (in amperes) as input.

Test Cases:

```
Enter Voltage (in volts): 85
Enter Current (in Amperes): 3
The power is 255 watts
```

```
Enter Voltage (in volts): 4
Enter Current (in Amperes): 23.679
The power is 94.716 watts
```

Skill: Write a complete program that converts input into the required output

Programming Fundamentals

Week 03 - Lab Manual

Task 09(OP): You are building a C++ program for a health and wellness application. To calculate certain health-related statistics, you need to take a user's age in years as input and convert it into their age in days.

Notes

- Use **365 days** as the length of a year for this challenge.
- Ignore leap years and days between last birthday and now.

Test Cases:

```
Enter your age in years: 2
Your age in days is approximately 730 days
```

```
Enter your age in years: 77
Your age in days is approximately 28105 days
```

Task 10(OP): You are developing a C++ program to keep track of a cricket team's performance in the Asia Cup tournament. The program needs to take the number of wins, draws, and losses as input and calculate the number of points the cricket team has obtained so far, based on the following rules:

- Wins get 3 points.
- Draws get 1 point.
- Losses get 0 points.

Test Cases:

```
Enter the number of wins: 7
Enter the number of draws: 1
Enter the number of losses: 1
Pakistan has obtained 22 in Asia Cup Tournament
```

Skill: Write a complete program that converts input into the required output

```
Enter the number of wins: 0
Enter the number of draws: 2
Enter the number of losses: 1
Pakistan has obtained 2 in Asia Cup Tournament
```

Task 11(OP): Scientists have discovered that in four decades, the world will EXPLODE! It will also take three decades to make a spaceship to travel to a new planet that can hold the entire world population.

You must calculate the number of people there will be in three decades from now.

Make a variable **population** and take input from the user that is the world population now. Assume that every month, someone gives birth to n more people. Also take **n** from the user as input. Calculate the number of people there will be when the spaceship is created.

Test Cases:

```
Enter the current world population: 400
Enter the monthly birth rate (number of births per month): 3
Population in three decades will be: 1480
```

```
Enter the current world population: 897
Enter the monthly birth rate (number of births per month): 6
Population in three decades will be: 3057
```

Skill: Write a complete program that converts input into the required output

Programming Fundamentals

Week 03 - Lab Manual

Practice Tasks:

Task 1:

Scenario: Polygon Geometry Contest

In a prestigious mathematics competition called the "Polygon Geometry Contest," brilliant young mathematicians from all over the world gather to showcase their skills in geometry. The contest features a variety of problems related to polygons, and participants need to write code to solve these problems.

The Challenge:

The problem statement for this particular challenge is as follows:

"Given an n-sided regular polygon, calculate and print the total sum of internal angles (in degrees). Use the formula (n - 2) x 180, which gives the sum of all the measures of the angles of an n-sided polygon."

Where n>=3. (NO POLYGON EXIST HAVING LESS THAN 3 SIDES)

Test Cases:

-
```
Enter sides: 5
Sum of angles = 540
```
-
```
Enter sides: 57
Sum of angles = 9900
```

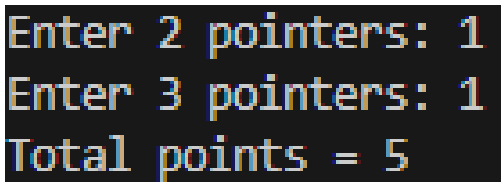
Task 2:

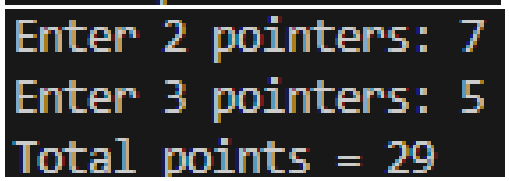
Write a C++ program that counts points for a basketball game, given the amount of 2-pointers scored and 3-pointers scored as input, calculate the final points for the team and print on the console

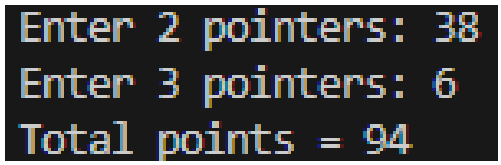
Examples

Test Cases:

Skill: Write a complete program that converts input into the required output

- 

- 

- 

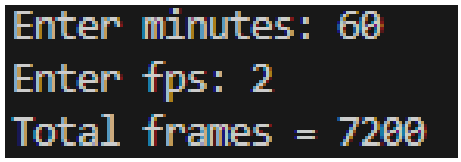
Task 3:

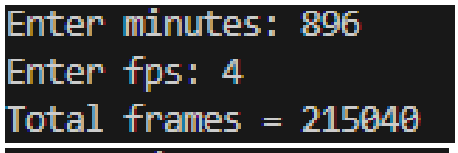
You are designing a program for a video processing application. The program needs to calculate the total number of frames that will be shown in a given the number of minutes for a certain frame per second (FPS). Take the number of minutes and frames per second as input from the user and calculate the total number of frames.

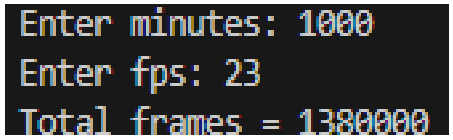
Formula:

frames = minutes × 60 × fps

Test Cases:

- 

- 

- 

Skill: Write a complete program that converts input into the required output

Programming Fundamentals

Week 03 - Lab Manual

Task 4:

Create a function that calculates the chance of being an imposter. The formula for the chances of being an imposter is `100 × (i / p)` where `i` is the imposter count (**floating point**) and `p` is the player count. Make sure to round the value to the nearest integer and return the value as a percentage.

Test Cases:

-
```
Enter imposters: 5
Enter players: 5
Chance = 100%
```
-
```
Enter imposters: 17
Enter players: 2
Chance = 850%
```
-
```
Enter imposters: 2
Enter players: 21
Chance = 9.52381%
```

Notes

The player limit is `10` and the imposter count can only go up to `3`.

Task 5:

I'd like to calculate how long on average I've lived in a single house.

Given a person's `age` and the number of times they've moved house as `moves`, return the average number of years that they've spent living in the same house.

Test Cases:

- ```
  Enter age: 30
  Enter moves: 1
  Average years = 15
  ```
- ```
  Enter age: 15
  Enter moves: 2
  Average years = 5
  ```
- ```
  Enter age: 80
  Enter moves: 0
  Average years = 80
  ```

Notes

- You can assume that the tests include people who've always lived in a house.
- Round to the nearest year.

Task 7:

I have a bucket containing an amount of navy blue paint and I'd like to paint as many walls as possible. Create a function that returns the number of complete walls that I can paint, before I need to head to the shops to buy more.

- `n` is the number of square meters I can paint.
- `w` and `h` are the widths and heights of a single wall in meters.

```
Formula: n/ (w x h)
```

Examples

- ```
  Enter paint area: 100
  Enter width: 4
  Enter height: 5
  Walls painted = 5
  ```

Skill: Write a complete program that converts input into the required output

Programming Fundamentals

Week 03 - Lab Manual

-
```
Enter paint area: 41
Enter width: 3
Enter height: 6
Walls painted = 2
```
-
```
Enter paint area: 10
Enter width: 15
Enter height: 12
Walls painted = 0
```

Notes

- Don't count a wall if I don't manage to finish painting all of it before I run out of paint.
- All walls will have the same dimensions.
- All numbers will be positive integers.

Complete all tasks and push them to GitHub before the deadline. For late submissions, **10%** of the total **marks will be deducted** for each day past the deadline. (Rule for all coming labs)

Good Luck and Best Wishes !!

Happy Coding ahead :)

Skill: Write a complete program that converts input into the required output