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## SWE20004 Technical Software Development

## Lab 2 (week 2)

**In this lab you will investigate C++ Standard Libraries /Commands**

**Before you start the lab exercise, download an appropriate C++ IDE to run your commands and programs.**

1. Answer the following questions? (investigate/analyse). Don't copy and paste – write down what it is - in your own words briefly.

1.1 what is the purpose of <iostream> in C++?

> Its purpose is to provide the fundamental input and output functions for C++ programs. In addition, it specifies input stream objects such as cin, cout, etc.

1.2 Which standard library in C++ contains function prototypes for stream manipulators that format streams of data?

> It's the <iomanip> library

1.3 What does <cmath> used for?

> It's used for providing functions which are used to perform mathematical equations, such as pow(a) for finding a^2 (or a*a), or sqrt() for finding the square root

1.4 Which standard library contains function prototypes for C-style string-processing functions?

> It's the <cstring> library. They are similar to regular strings, yet they have an extra null character at the end of the string that distinguishes them from the normal strings

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1.5 Classify these identifiers as: 1. Valid, 2. Bad style, 3. Invalid. If not valid, explain why.

| Identifier | Valid | Bad style (valid) | Explanation |
|---|---|---|---|
| $gravy | **Invalid** | | **No special character other than the underscore can be used** |
| .hidden_variable | **Invalid** | | **Dots cannot be used in identifiers** |
| USER_INPUT_DEGREES | | **Bad style** | **The use of underscore is unnecessary** |
| string | **Valid** | | |
| String | **Valid** | | |
| number-of-choices | **Invalid** | | **Hyphen cannot be used in identifiers** |
| time | **Invalid** | | *time( )* **is a function** |
| b^2 | **Invalid** | | **^ cannot be used in identifiers** |
| Temperature | **Valid** | | |
| 3com_card_ID | **Invalid** | | **Identifiers can only start from alphabets** |
| __my_constant__ | | **Bad style** | **Could reduce the number of underscores, for example:** *my_constant* |

2.   Programming exercises

2.1 What is the keyword for declaring a boolean number in C++?
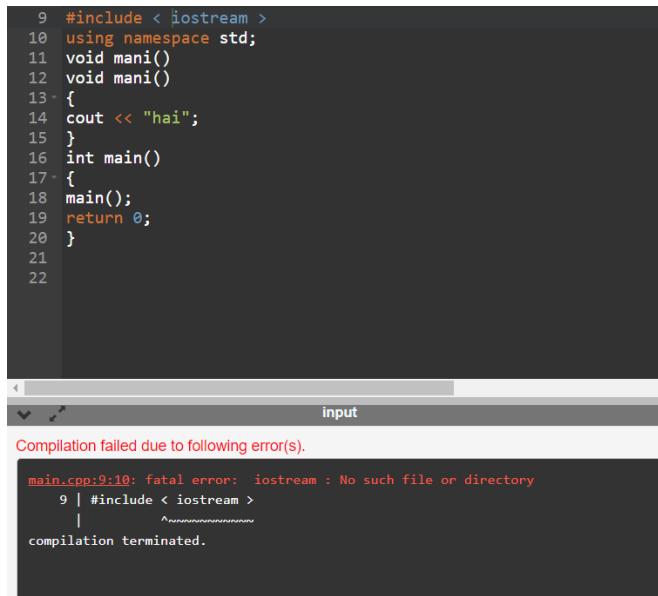
It's the keyword 'bool'

2.2    Which of the following functions will correctly return true if its argument is an odd integer? Explain why?

I. bool Is Odd (int x) {
        return (x % 2 == 1);
        }
II. bool IsOdd (int x) {
        return (x / 2 == 1);
        }
III. bool IsOdd (int x) {
        if (x % 2 == 1)
        return true;
        else
        return false;
        }

Function I and III are correct. Both the functions find the remainer of the divison by 2. If the remainer equal to 1, it returns true; otherwise, it returns false. Function III is a more detailed version of I.

2.3 What is the output of this program?

```cpp
#include < iostream >
using namespace std;
void mani()
void mani()
{
cout << "hai";
}
int main()
{
main();
return 0;
}
```

```
 9   #include < iostream >
10   using namespace std;
11   void mani()
12   void mani()
13 ▸ {
14   cout << "hai";
15   }
16   int main()
17 ▸ {
18   main();
19   return 0;
20   }
21
22
```

input

Compilation failed due to following error(s).
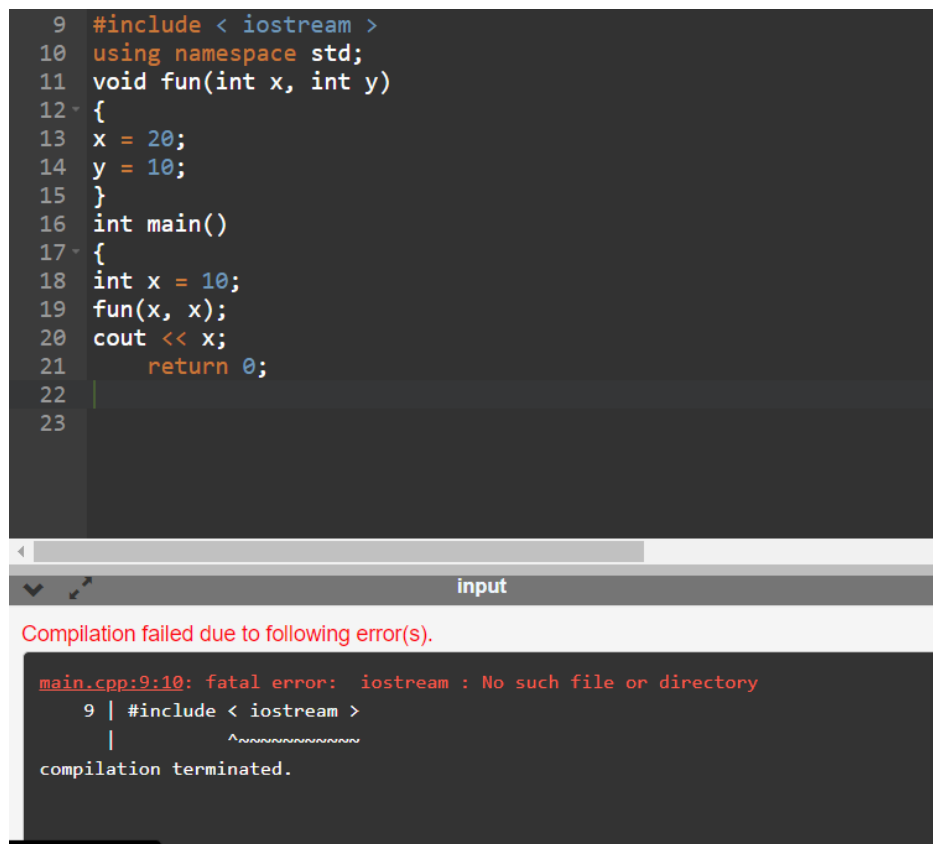
```
main.cpp:9:10: fatal error:  iostream : No such file or directory
     9 |  #include < iostream >
       |          ^~~~~~~~~~~~~
compilation terminated.
```

Nothing will be printed, as there shouldn't be any space in <iostram> in line 1, and there is a missing semicolon in line 2

2.4 What is the output of this program?

```cpp
#include < iostream >
using namespace std;
void fun(int x, int y)
{
x = 20;
y = 10;
}
int main()
{
int x = 10;
fun(x, x);
cout << x;
return 0;
```

Nothing will be printed, as there shouldn't be any space in <iostram> in line 1, and there is a missing '{' at the end of the program.

```cpp
 9  #include < iostream >
10  using namespace std;
11  void fun(int x, int y)
12 ▾ {
13  x = 20;
14  y = 10;
15  }
16  int main()
17 ▾ {
18  int x = 10;
19  fun(x, x);
20  cout << x;
21      return 0;
22  |
23
```
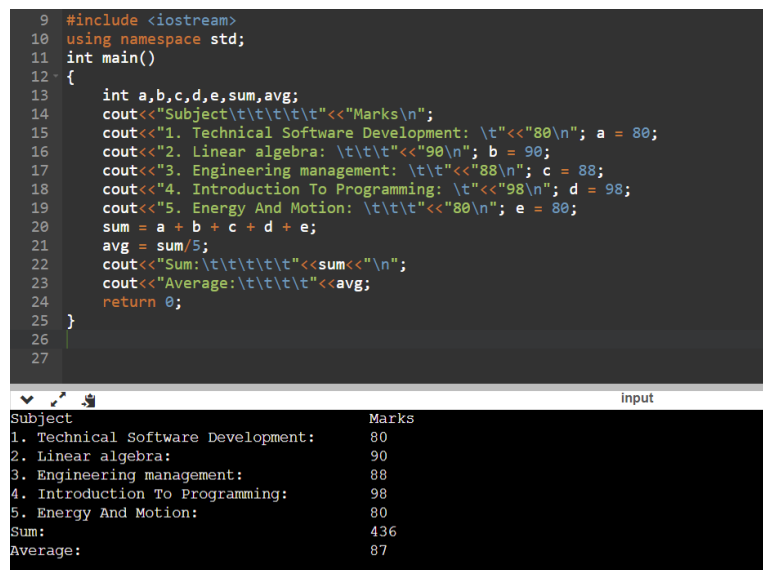
input

Compilation failed due to following error(s).

```
main.cpp:9:10: fatal error:  iostream : No such file or directory
    9 | #include < iostream >
      |          ^~~~~~~~~~~~~
compilation terminated.
```

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3. Write a code to calculate the Sum and Average of any 5 subjects and display the output on screen.

| | Subject | Marks |
|---|---|---|
| 01 | Technical Software Development | 80 |
| 02 | -- | |
| 03 | -- | |
| 04 | -- | |
| 05 | -- | |
| | **Sum** | …… |
| | **Average** | …… |

```cpp
#include <iostream>
using namespace std;
int main()
{
    int a,b,c,d,e,sum,avg;
    cout<<"Subject\t\t\t\t\t"<<"Marks\n";
    cout<<"1. Technical Software Development: \t"<<"80\n"; a = 80;
    cout<<"2. Linear algebra: \t\t\t"<<"90\n"; b = 90;
    cout<<"3. Engineering management: \t\t"<<"88\n"; c = 88;
    cout<<"4. Introduction To Programming: \t"<<"98\n"; d = 98;
    cout<<"5. Energy And Motion: \t\t\t"<<"80\n"; e = 80;
    sum = a + b + c + d + e;
    avg = sum/5;
    cout<<"Sum:\t\t\t\t\t"<<sum<<"\n";
    cout<<"Average:\t\t\t\t"<<avg;
    return 0;
}
```

```cpp
 9  #include <iostream>
10  using namespace std;
11  int main()
12  {
13      int a,b,c,d,e,sum,avg;
14      cout<<"Subject\t\t\t\t\t"<<"Marks\n";
15      cout<<"1. Technical Software Development: \t"<<"80\n"; a = 80;
16      cout<<"2. Linear algebra: \t\t\t"<<"90\n"; b = 90;
17      cout<<"3. Engineering management: \t\t"<<"88\n"; c = 88;
18      cout<<"4. Introduction To Programming: \t"<<"98\n"; d = 98;
19      cout<<"5. Energy And Motion: \t\t\t"<<"80\n"; e = 80;
20      sum = a + b + c + d + e;
21      avg = sum/5;
22      cout<<"Sum:\t\t\t\t\t"<<sum<<"\n";
23      cout<<"Average:\t\t\t\t"<<avg;
24      return 0;
25  }
26
27
```

```
                                              input
Subject                                Marks
1. Technical Software Development:      80
2. Linear algebra:                     90
3. Engineering management:             88
4. Introduction To Programming:        98
5. Energy And Motion:                  80
Sum:                                   436
Average:                               87
```

4. Programming problem

(Hint: You will have to import a package in your program using the #include directive which will allow you to use some of the mathematical functions involved in the formula given in this exercise. Find out which package it is and the functions involved, import the package and use the functions to complete the program)

The current flowing through an AC circuit composed of a resistor (resistance R measured in Ohms), a capacitor (capacitance C measured in Farads) and an inductor (inductance L measured in Henrys) can be calculated using the following equation:

$$I = \frac{E}{\sqrt{R^2 + \left(2\pi FL - \frac{1}{2\pi FC}\right)^2}}$$

I = Current in Amps
E = Electromotive Force in Volts
R = Resistance in Ohms
F = Frequency of the Current in Hertz
L = Inductance in Henrys
C = Capacitance in Farads

Where, F is frequency (measured in Hz), E is EMF (Voltage) and I is current (measured in Amps).

    A. Write a C++ program which does the following:
        a. Declares PI as a constant and sets its value to 3.14159,
        b. Declares all other variables described above as local variables.
        c. Prompts for the input of (and inputs) resistance, frequency, capacitance, inductance and EMF.
        d. Calculates and displays the current.
    B. Test your program with this test data:

f=200 Hz

R=15 Ohms

C=0.0001 (100☐F)

L=0.01476 (14.76mH)

E = 15 V

Answer: I = 0.816918A (calculated)

```cpp
#include <iostream>
#include <cmath>
using namespace std;
int main()
{
    float i,e,r,f,l,c, pi = 3.14159;
    float a1, a2, a3, a4, a5;
    cout<<"Please input the frequency value in Hz: "; cin>>f;
    cout<<"Please input the inductance value in H: "; cin>>l;
    a1 = 2*pi*f*l;
    cout<<"Please input the capacitance value in F: "; cin>>c;
    a2 = 1/(2*pi*f*c);
    a3 = a1 - a2;
    cout<<"Please input the resistance value in Ω: "; cin>>r;
    a4 = (r*r) + (a3*a3);
    a5 = sqrt(a4);
    cout<<"Please input the EMF value in V: "; cin>>e;
    i = e/a5;
    cout<<"The value of I in A is: "<<i<<" A";
    return 0;
}
```

```
 9  #include <iostream>
10  #include <cmath>
11  using namespace std;
12  int main()
13 ▾ {
14      float i,e,r,f,l,c, pi = 3.14159;
15      float a1, a2, a3, a4, a5;
16      cout<<"Please input the frequency value in Hz: "; cin>>f;
17      cout<<"Please input the inductance value in H: "; cin>>l;
18      a1 = 2*pi*f*l;
19      cout<<"Please input the capacitance value in F: "; cin>>c;
20      a2 = 1/(2*pi*f*c);
21      a3 = a1 - a2;
22      cout<<"Please input the resistance value in Ω: "; cin>>r;
23      a4 = (r*r) + (a3*a3);
24      a5 = sqrt(a4);
25      cout<<"Please input the EMF value in V: "; cin>>e;
26      i = e/a5;
27      cout<<"The value of I in A is: "<<i<<" A";
28      return 0;
29  }
30
```

```
                                                    input
Please input the frequency value in Hz: 200
Please input the inductance value in H: 0.01476
Please input the capacitance value in F: 0.0001
Please input the resistance value in Ω: 15
Please input the EMF value in V: 15
The value of I in A is: 0.816918 A

...Program finished with exit code 0
Press ENTER to exit console.
```

## Report (SWE20004)

Write a one-page report on this lab covering the following:

1. Summarize the topics you explored and the activities you did during this lab.
2. Classify (group) these topics and actions under appropriate headings. Do not just copy the headings used in the instructions. For example, explain the following, what are the following commands do?
3. Discuss the relevance of these topics and actions in terms of C++ programming. i.e. How do the things in this lab work contribute to your understanding of C++ programming overall?
4. Why do you need to understand (and use) C++ commands/standard libraries?

This report is worth 5% towards your unit assessment. Use the below page as a template. Either you can type it or write it in your words.

For this week, we investigated further into the C++ language. More specifically, we were taught about some of the Standard Libraries as well as Commands. In addition, we also did some of the exercises in this week's labs in order to strengthen our knowledge and understanding of the use of the specific commands.

**1. Standard Libraries**

For this week's lab, we focused on learning these 4 following Standard Libraries:

First is the <iostream> library. This is one of the basic and most essential libraries in C++, as most of the programs need this library to be able to execute. As mentioned above, its purpose is to provide the fundamental input and output functions for C++ programs. In addition, it specifies input stream objects such as cin, cout, etc.

The second one is the <iomanip> library. This standard library is part of the input and output library and contains function prototypes for stream manipulators that format streams of data.

The third one is the <cmath> library. Its purpose is to provide functions that are used to perform mathematical equations. In my opinion, this library is very useful for me as I usually do mathematic problems and I need this library to find the square root of a number using sqrt(), or to find the sine or cosine of an angle using cos() and sin().

The fourth and final one is the <cstring> library, which contains function prototypes for C-style string-processing functions. Personally, I do not find myself using this library in many situations, therefore I am not entirely sure about whether the exclusion of this in programs would affect anything (i.e. the program cannot be executed without it).

**2. Commands**

Apart from the mentioned cout, cin and several commands which we studied during last week's lab, we were introduced to the #include and #if command.

The #include command is used in including the files and the standard libraries in the code and making use of them. This command can be seen very frequently at the start of most programs. This command can be used in two ways, either ***#include <name>*** or ***#include "name"***.

As for the #if command, it helps in specifying conditions that should be followed. This allows the user to apply logic control in a simple manner; if the condition is met, the code will immediately execute the command that will be compiled.

**3. Lab exercises**

This week's lab exercises were relatively more complicated than the previous week, as we have to figure out the errors in the program, as well as there are more calculations to do. They are however still manageable and can be finished during the lab session.

Overall, this week's lab helped us to understand further the standard libraries and commands in the C++ language, as having a good understanding of these will make you use the C++ language more effectively and efficiently as you now understand the use of each library and command, which also result in fewer errors in your programs. I also feel more confident in my ability to understand the C++ language and know how to create a working program for calculating mathematics problems.

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