CS101 Lab Quiz 1 - Batch B
13 Feb 2024 - 20:45 hrs to 22:15 hrs
4 Compulsory Questions - 40 Marks

Instructions:

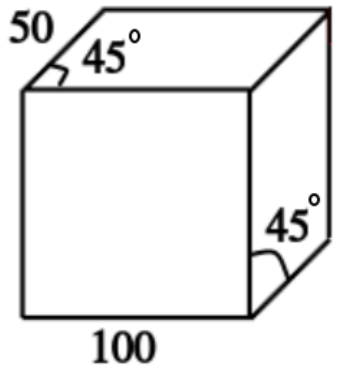
- Keep your ID card on the table for ready reference. If your ID card isn't with you, you won't be allowed to appear for the quiz/exam.
- Keep your phones, tablets, notes, bags, books, etc. near the instructor's platform.
- Rough sheets will be provided to you.
- Create a folder on your `Desktop` and name it `submission_YourRollNumber`
  E.g.: If my roll number is `23k1234` then my folder name is **`submission_23k1234`**
- Create all four programs in the newly created folder.
- Name the program files as mentioned in this pdf only.
- No clarifications will be provided for any question by anyone (TAs/Instructor). When in doubt, make suitable assumptions, state them clearly as comments in your program file itself, and proceed to solve the problem.
- Please note that your answers should NOT include any programming concept that hasn't been covered in the class. You are not allowed to use arrays, functions, strings, or any advanced concepts of C/C++. Such solutions will NOT be graded.
- Marks will be given for each hidden test case that passes.

Filename: LQ01_B_Q1.cpp **(8 Marks)**

Write a program to draw the figure given below. The entire figure should be clearly visible on the screen. The dimensions of the lines and the angles are mentioned in the figure itself. Note that the length and the angles should not be drawn; they are just for illustration purposes.

Rubrics:

- Its ok if the size of the length is not exact. It should look similar to the one above



Solution:

```
#include<simplecpp>
main_program{
    turtleSim();
    repeat(4){//for building the front square.
        left(90);
        forward(100);
    }
    //constructing the right part of the cube.
    left(45);
    forward(50);
    left(45);
    forward(100);
    left(135);
    forward(50);
    //constructing the top
    right(45);
    forward(100);
    right(135);
    forward(50);
    right(45);
    forward(100);
    wait(5);
    return 0;
}
```

Filename: LQ01_B_Q2.cpp **(8 Marks)**

Write a C++ program to accept four numbers from the user `a, b, c, and d` and compute the addition of (a/b) with (c/d). The formula to compute the addition of two fractions is given below. Print the final value as output on the screen.

$$\frac{a}{b} + \frac{c}{d} = \frac{a*d + b*c}{b*d}$$

Input Format:

The input consists of **four integer variables separated by a space**, Each representing a, b, c, and d, respectively.

Constraints (Assume):

1 <= a, b, c, d <= 100

Output Format:
Print the expression value obtained as a floating point number on the screen.

***Note**:*

- Do not write any C++ statements for printing general messages. For example, the following **should NOT** be present in your program:
    a. **cout << "Enter a number:"**,
    b. **cout << "The computed answer is"**, etc.
  In addition, **do not** print unnecessary spaces unless specified in the program.
- You just have to print the result.

Practice Test Cases (4):

Input	Output
4 2 4 2	4
5 2 5 4	3.75
10 20 20 10	2.5
70 80 90 95	1.82237

Evaluate Test case

Input	**Output**	**Marks**
20 10 20 10	4	2
41 80 65 20	3.7625	2
5 2 10 2	7.5	2
50 10 25 50	5.5	2

Solution:

```
#include <simplecpp>

int main() {
    int a, b, c, d;
    cin>>a>>b>>c>>d;

    // ((a/b) + (c/d)) = ((a*d + b*c) / (b*d))
```

```
    float numerator = (a*d) + (b*c) ;
    float denominator = b*d;
    float result = numerator / denominator;
    cout<<result;
}
```

Filename: LQ01_B_Q3.cpp **(10 marks)**

Write a C++ program to print the value of the largest number among the three integers taken as input.

Input Format:
The input consists of **three integer variables separated by a space**, Each representing a, b, and c, respectively.

Constraints (Assume):
-100 <= a, b, c <= 100

Output Format:
Print the largest value obtained as a single integer on the screen.

***Note**:*

- Do not write any C++ statements for printing general messages. For example, the following **should NOT** be present in your program:
    a. **cout << "Enter a number:"**,
    b. **cout << "The computed answer is"**, etc.
  In addition, **do not** print unnecessary spaces unless specified in the program.
- You just have to print the the number.

Practice Test Cases (5):

Input	Output
1 2 3	3
0 10 -2	10
-20 -10 -5	-5
50 55 50	55
68 68 68	68

Evaluate Test case

Input	Output	Marks
10 20 30	30	2
5 2 2	5	2
0 0 0	0	2
-10 -3 -1	-1	2
-20 -8 -10	-8	2

Solution:

```
#include <simplecpp>

main_program{
    int num1, num2, num3;   // Define 3 variables for storing the 3
numbers
    cin>>num1>>num2>>num3;

    if (num1 >= num2 && num1 >= num3)     // num1 is the largest
    cout<<num1;

    else if(num2 >= num1 && num2 >= num3) // num2 is the largest
    cout<<num2;

    else                                  // num3 is the largest
    cout<<num3;
}
```

Filename: LQ01_B_Q4.cpp **(14 marks)**

Write a program to accept n and r from the user, compute $^{n}C_{r}$, and print the result.

$$^{n}C_{r} = \frac{n!}{r!\,(n-r)!}$$

A naive approach would be to calculate the factorial of n, factorial of `r`, and factorial of `n-r` and then

finally compute the result as given in the formulae above. However, calculating the factorial of a large number can be tricky, and the result may overflow due to the limitation of the size of data type. So, you need to think of another approach to solve this.

The inputs i.e. n and r will be integers, but you are free to use other data types, including `long double`. However, as stated above, think about overflow and write code that minimizes the risk.

Input Format:
The input consists of **two integer variables separated by a space**, Each representing n and r, respectively.

Constraints:
1 <= r <= n
1 <= n <= 35000

Output Format:
Print the final value obtained as a single integer on the screen.

***Note**:*

- Do not write any C++ statements for printing general messages. For example, the following **should NOT** be present in your program:
    a. **cout << "Enter a number:"**,
    b. **cout << "The computed answer is"**, etc.
  In addition, **do not** print unnecessary spaces unless specified in the program.
- You just have to print the number.

Practice Test Cases (6):

Input	Output
10 6	210
13 10	286
789 700	2.40552e+119
2000 1800	6.86395e+280
32555 31900	8.04488e+1390
32000 31900	3.00431e+292

Evaluate Test case

Input	Output	Marks
20 10	184756	2
17 11	12376	2
500 400	2.04169e+107	2
800 756	6.14097e+72	2
2100 1900	1.97071e+285	2
3200 3000	2.36807e+323	2
32567 31234	1.21179e+2415	2

Solution:

```
#include <simplecpp>

main_program{
    int n, r;   // Define variables for n and r
    cin>>n>>r;

    // Numerator will go from n -> r+1
    // Denominator will go from 1 -> n-r

    int numerator = n;
    int denominator = 1;

    int min_numerator = r+1;
    int max_denominator = n - r;

    int result = 1;     // Stores the final result

    while (numerator >= min_numerator || denominator <= max_denominator) {
// Loop till any of the condition is true
        if (numerator >= min_numerator)     // Only execute if more
numerators are remaining
        result = result * numerator;
```

```
        if (denominator <= max_denominator) // Only execute if more
denominators are remaining
        result = result / denominator;

        numerator --;
        denominator ++;
    }

    cout<<result;
    return 0;
}
```