WORKSHEET 2

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Question 1.1

Task 1: Basic student grading system prototype using classes and objects. [30 Marks]

Write a program that manages a simple student grade calculator with the following requirements. Create a Student class that has:

1. Student name (string)
2. Three subject marks (integers)
3. A basic member function to calculate average

The program should:

1. Accept student details (name and marks) from user input
2. Calculate and display:
    1. Total marks
    2. Average marks
    3. Grade (A for ≥90%, B for ≥80%, C for ≥70%, D for ≥60%, F for <60%)
3. Display a message if any mark is below 0 or above 100

CODE:

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

class Student { // Class to handle student info and grades
    string name; // Store student's name
    int marks[3]; // Store marks for 3 subjects
```

```
public:
    void getDetails() { // Ask user for name and marks
        cout << "Enter student name: ";
        cin >> name;
        cout << "Enter marks for 3 subjects: ";
        for (int i = 0; i < 3; i++) {
        cin >> marks[i];
        if (marks[i] < 0 || marks[i] > 100) { // Check if marks are valid
        cout << "Marks must be between 0 and 100!\n";
        return;
        }
        }
    }
    int calculateTotal() { // Add up all the marks
        return marks[0] + marks[1] + marks[2];
    }
    float calculateAverage() { // Find the average
        return calculateTotal() / 3.0;
    }
    char calculateGrade() { // Give grade based on average
        float avg = calculateAverage();
        if (avg >= 90) return 'A';
        else if (avg >= 80) return 'B';
        else if (avg >= 70) return 'C';
```

```
        else if (avg >= 60) return 'D';
        else return 'F';
    }
    void displayResults() { // Show all details
        cout << "\nStudent Name: " << name << endl;
        cout << "Total Marks: " << calculateTotal() << endl;
        cout << "Average Marks: " << calculateAverage() << endl;
        cout << "Grade: " << calculateGrade() << endl;
    }
};
int main() { // Program starts here
    Student student; // Create a student
    student.getDetails(); // Input details
    student.displayResults(); // Show results
    return 0;
}
```

OUTPUT:

```
"D:\Weekly c++\Worksheet 2'

Enter student name: Ayan
Enter marks for 3 subjects: 45 56 68

Student Name: Ayan
Total Marks: 169
Average Marks: 56.3333
Grade: F

Process returned 0 (0x0)   execution time : 23.786 s
Press any key to continue.
```

Question 2.1

1. Write a program with a class Circle having:
    1. Private member: radius (float)
    2. A constructor to initialize radius
    3. A friend function compareTwoCircles that takes two Circle objects and prints which circle has the larger area

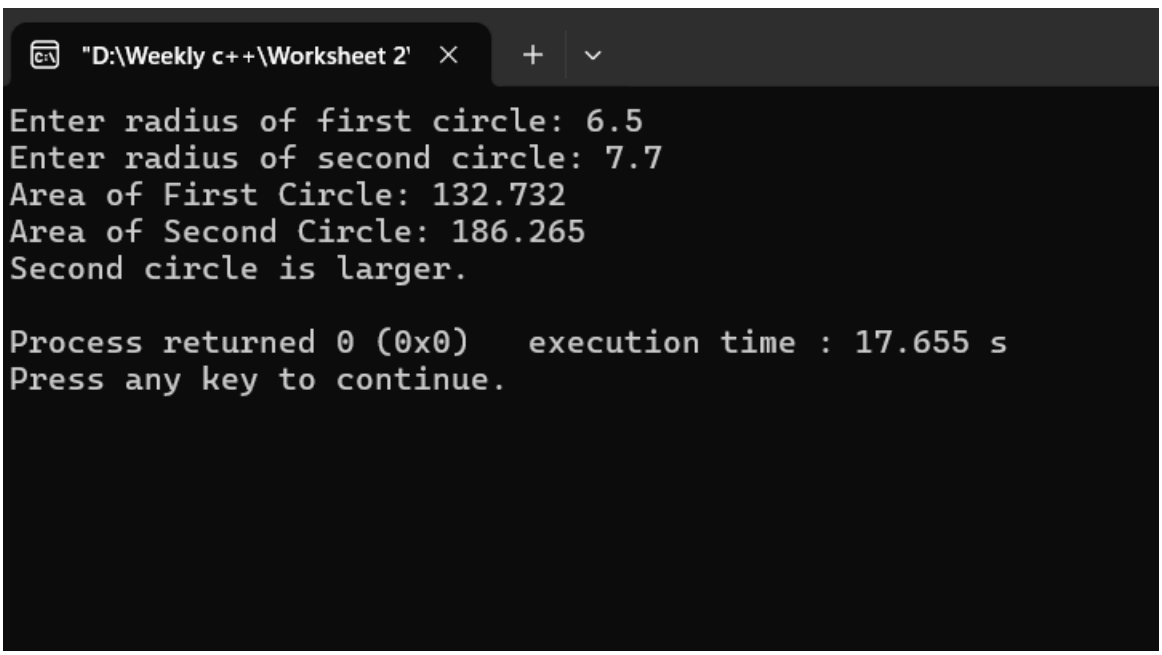
CODE:

```
#include <iostream>

using namespace std;


class Circle {
```

```
private:
  float radius; // To store the radius of the circle
public:
  Circle(float r) { // Constructor to set the radius
    radius = r;
  }
  float getArea() const { // Function to find area of the circle
    return 3.14159 * radius * radius;
  }
  void compareWith(const Circle& other) const { // Function to compare two circles
    float area1 = getArea();
    float area2 = other.getArea();
    cout << "Area of First Circle: " << area1 << endl;
    cout << "Area of Second Circle: " << area2 << endl;
    if (area1 > area2) {
    cout << "First circle is larger.\n";
    } else if (area2 > area1) {
    cout << "Second circle is larger.\n";
    } else {
    cout << "Both circles are equal in area.\n";
    }
  }
};
int main() { // Main program starts here
float r1, r2;
  cout << "Enter radius of first circle: ";
```

```
    cin >> r1;
    cout << "Enter radius of second circle: ";
    cin >> r2;
    Circle circle1(r1); // Create first circle
    Circle circle2(r2); // Create second circle
    circle1.compareWith(circle2); // Compare the two circles
    return 0;
}
```

OUTPUT:



Question 2.2

1. Create a program with these overloaded functions named findMax:
    1. One that finds maximum between two integers
    2. One that finds maximum between two floating-point numbers

3. One that finds maximum among three integers

One that finds maximum between an integer and a float**.**

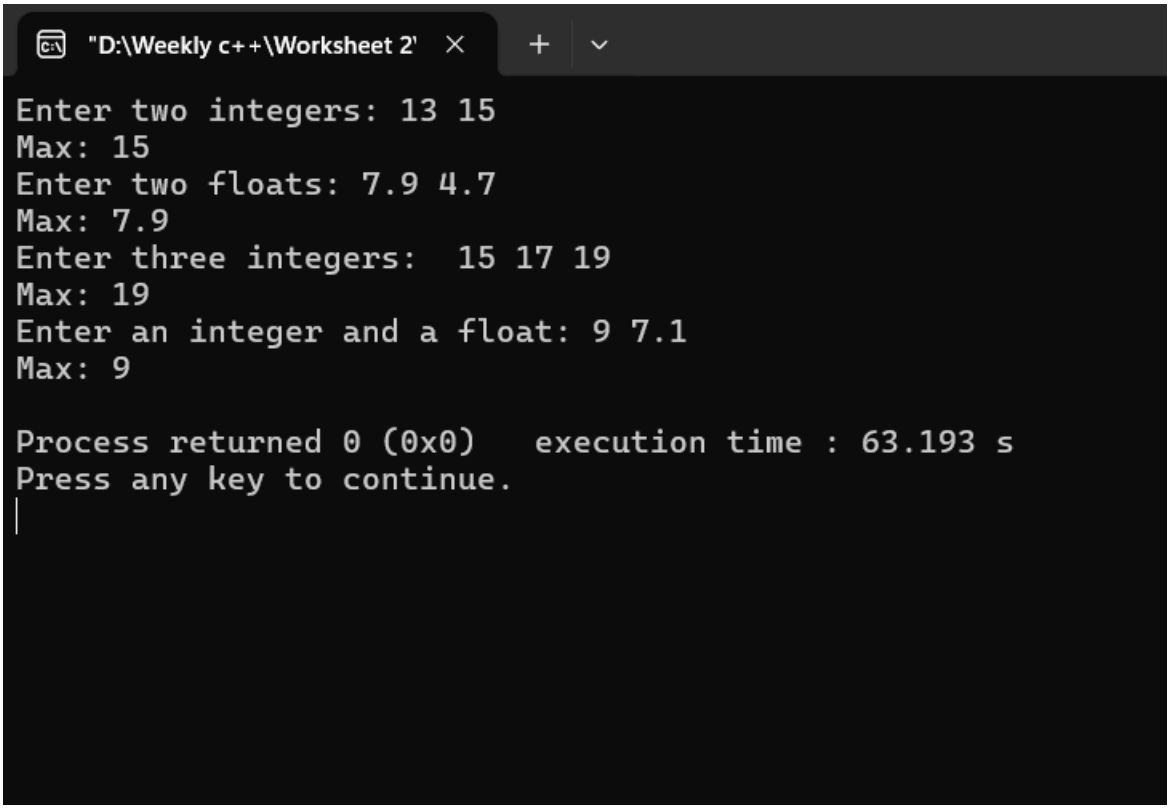
Code:

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

class Circle {
private:
   float radius; // Stores the radius of the circle
public:
   Circle(float r) { // Constructor to initialize radius
   radius = r;
   }
   float getArea() const { // Function to calculate area of the circle
   return 3.14159 * radius * radius;
   }

   friend void compareTwoCircles(const Circle& c1, const Circle& c2);
// Friend function declaration
};
```

```
void compareTwoCircles(const Circle& c1, const Circle& c2) {    //
Friend function definition
    float area1 = c1.getArea();
    float area2 = c2.getArea();
    cout << "Area of First Circle: " << area1 << endl;
    cout << "Area of Second Circle: " << area2 << endl;
    if (area1 > area2) {
    cout << "First circle is larger." << endl;
    } else if (area2 > area1) {
    cout << "Second circle is larger." << endl;
    } else {
    cout << "Both circles have the same area." << endl;
    }
}
int main() { // Main program starts here
    float r1, r2;
    cout << "Enter radius of first circle: ";
    cin >> r1;
    cout << "Enter radius of second circle: ";
    cin >> r2;
    Circle circle1(r1); // Create first Circle object
    Circle circle2(r2); // Create second Circle object
```

```
    compareTwoCircles(circle1, circle2); // Call the friend function to compare

return 0;

}
```

OUTPUT:



Question 3.1

Write a program that reads the titles of 10 books (use an array of 150 characters) and writes them in a binary file selected by the user. The program should read a title and display a message to indicate if it is contained in the file or not.

CODE:

```
#include <iostream>
#include <fstream>  // For file operations
#include <cstring>  // For using strcmp
using namespace std;

int main() {
   char bookTitles[10][150];  // Array to store 10 book titles (each up to
150 characters)
   ofstream outFile;          // Output file stream to write into a file

   // Open a binary file in append mode (creates file if it doesn't exist)
   outFile.open("bookTitles.dat", ios::binary | ios::app);
   if (!outFile) {
   cout << "Error: Could not open file for writing!" << endl;
   return 1; // Exit if file can't be opened
   }

   // Take 10 book titles from the user
   cout << "Enter titles of 10 books:" << endl;
   cin.ignore(); // Clear the input buffer before taking input
```

```
    for (int i = 0; i < 10; i++) {
        cout << "Book " << i + 1 << ": ";
        cin.getline(bookTitles[i], 150); // Read the whole line as title
        outFile.write(bookTitles[i], sizeof(bookTitles[i])); // Save the title
to the file
    }

    outFile.close(); // Close the file after writing all titles

    // Now ask the user for a title to search
    char searchTitle[150];
    cout << "\nEnter a book title to search: ";
    cin.getline(searchTitle, 150); // Take the title to search
    ifstream inFile("bookTitles.dat", ios::binary); // Open the file for
reading
    if (!inFile) {
    cout << "Error: Could not open file for reading!" << endl;
    return 1; // Exit if file can't be opened
    }
    bool found = false; // To keep track if title is found
    char title[150];    // Temporary array to hold titles from file
    // Read titles one by one and compare
    while (inFile.read(title, sizeof(title))) {
```

```
    if (strcmp(title, searchTitle) == 0) { // Compare the searched title with
file title
    found = true;
    break; // No need to search further
        }
    }
    inFile.close(); // Always close the file after reading
    // Show result
    if (found) {
    cout << "Title found in the file!" << endl;
    } else {
    cout << "Title not found in the file." << endl;
    }

    return 0; // End of program
}
```

OUTPUT:

```
"D:\Weekly c++\Worksheet 2'

Enter titles of 10 books:

Book 1: English
Book 2: math
Book 3: science
Book 4: nepali
Book 5: databse
Book 6: c++
Book 7: computer
Book 8: economic
Book 9: biology
Book 10: physics

Enter a book title to search: math
Title found in the file!

Process returned 0 (0x0)   execution time : 50.922 s
Press any key to continue.
```

Question 3.2

Create a program that:

1. Reads student records (roll, name, marks) from a text file
2. Throws an exception if marks are not between 0 and 100
3. Allows adding new records with proper validation
4. Saves modified records back to file

CODE:

```
#include <iostream>
#include <fstream>   // for reading and writing files
#include <stdexcept> // for throwing exceptions
#include <string>
#include <vector>    // to store multiple student records
using namespace std;

// Structure to store student information
struct Student {
    int roll;
    string name;
    int marks;
};

// Function to check if marks are valid (0 to 100)
void validateMarks(int marks) {
    if (marks < 0 || marks > 100) {
        throw out_of_range("Marks must be between 0 and 100.");  //
Throw error if marks are invalid
    }
}
```

```
// Function to read students from a file
vector<Student> readRecords(string fileName) {
    vector<Student> students;
    ifstream inFile(fileName);   // Open file for reading

    if (!inFile) {
        cout << "File not found. A new file will be created later.\n";
        return students;  // Return empty list if file does not exist
    }

    Student student;
    // Read data until end of file
    while (inFile >> student.roll >> student.name >> student.marks) {
        students.push_back(student);  // Add student to the list
    }
    inFile.close();  // Close the file
    return students;
}

// Function to save all student records to a file
void saveRecords(string fileName, vector<Student> students) {
```

```
    ofstream outFile(fileName);  // Open file for writing (this will
overwrite old content)

    if (!outFile) {
        cout << "Error opening file for saving!\n";
        return;
    }

    for (const auto& student : students) {
        outFile << student.roll << " " << student.name << " " <<
student.marks << endl;  // Write each student's data
    }
    outFile.close();  // Close the file
}

int main() {
    string fileName = "students.txt";
    vector<Student> students = readRecords(fileName);  // Read old
records

    // Show old student records
    if (!students.empty()) {
        cout << "Current Student Records:\n";
```

```
        for (const auto& student : students) {
            cout << "Roll: " << student.roll << ", Name: " << student.name
<< ", Marks: " << student.marks << endl;
        }
    } else {
        cout << "No student records available.\n";
    }

    int choice;
    cout << "\nWhat do you want to do?\n";
    cout << "1. Add a new student\n";
    cout << "2. Update marks of a student\n";
    cout << "Enter your choice: ";
    cin >> choice;

    if (choice == 1) {
        // Add a new student
        Student newStudent;
        cout << "Enter Roll Number: ";
        cin >> newStudent.roll;
        cin.ignore();  // Clear the buffer
        cout << "Enter Name: ";
```

```
    getline(cin, newStudent.name);
    cout << "Enter Marks: ";
    cin >> newStudent.marks;

    try {
        validateMarks(newStudent.marks);  // Check if marks are valid
        students.push_back(newStudent);   // Add student to the list
        cout << "New student added successfully.\n";
    } catch (const out_of_range& e) {
        cout << "Error: " << e.what() << endl;
    }

} else if (choice == 2) {
    // Modify marks of an existing student
    int rollNumber;
    cout << "Enter Roll Number to update marks: ";
    cin >> rollNumber;

    bool found = false;
    for (auto& student : students) {
        if (student.roll == rollNumber) {
            found = true;
```

```
            cout << "Enter new marks: ";
            int newMarks;
            cin >> newMarks;

            try {
                validateMarks(newMarks);  // Check if new marks are valid
                student.marks = newMarks;  // Update marks
    cout << "Marks updated successfully.\n";
    }
     catch (const out_of_range& e) {
    cout << "Error: " << e.what() << endl;
        }
    break;
        }
        }
    if (!found) {
    cout << "Student with Roll Number " << rollNumber << " not
found.\n";
        }
    } else {
    cout << "Invalid choice! Please select 1 or 2.\n";
    }
```

```
    // Save all records back into the file
    saveRecords(fileName, students);
    return 0;
}
```

OUTPUT:

```
"D:\Weekly c++\Worksheet 2"

Current Student Records:
Roll: 1, Name: ayan, Marks: 66

What do you want to do?
1. Add a new student
2. Update marks of a student
Enter your choice: 2
Enter Roll Number to update marks: 1
Enter new marks: 69
Marks updated successfully.

Process returned 0 (0x0)   execution time : 23.473 s
Press any key to continue.
```