Question 1:

Create a class template Container that can hold a single value of any type. Then, specialize this template for the std::string type to add a member function printLength that prints the length of the string.

Input Format:

- The program expects the user to enter an integer and a string.
- There are no specific prompts for input.

Output Format:

- The program outputs the integer value stored in intContainer.
- If strContainer is specialized for std::string, it outputs the length of the string stored in strContainer.

Title for Question 1: Prints the length of the string

Solution:

```
#include <iostream>
#include <string>


template <typename T>
class Container {
public:
    Container() {} // Default constructor
    void setData(const T& value) {
        data = value;
    }
    T getData() const {
        return data;
    }
private:
    T data;
};
template <>
class Container<std::string> {
public:
    Container() {} // Default constructor
    void setData(const std::string& value) {
        data = value;
    }
    void printLength() {
        std::cout << "Length: " << data.length() << std::endl;
    }
private:
    std::string data;
};
int main() {
    Container<int> intContainer;
    Container<std::string> strContainer;
    int intInput;
    std::string stringInput;
    //std::cout << "Enter an integer: ";
    std::cin >> intInput;
    intContainer.setData(intInput);
    std::cin.ignore(); // Clear the newline character in the input buffer
    //std::cout << "Enter a string: ";
    std::getline(std::cin, stringInput);
    strContainer.setData(stringInput);
    std::cout << "Int Data: " << intContainer.getData() << std::endl;
    strContainer.printLength();
    return 0;
}
```

TestCases:

S.No	Inputs	Outputs
1	73 1234567890	Int Data: 73 Length: 10
2	100000 Another string with spaces.	Int Data: 100000 Length: 27
3	-1 Empty	Int Data: -1 Length: 5
4	999 A	Int Data: 999 Length: 1
5	12345 LongLongLongString	Int Data: 12345 Length: 18
6	-10 Short	Int Data: -10 Length: 5

White List:

Black List:

Question 2:

How can you read an integer from the user using cin, and handle the case where the user enters non-integer input?

Note: use input and output stream files.

Input Format:

- The program expects the user to enter an integer.
- There are no specific prompts for input.

Output Format:

- If the input is a valid integer, the program outputs "You entered: " followed by the entered integer.
- If the input is not a valid integer, it outputs "Invalid input. Please enter an integer."

Title for Question 2: Find integer or not

Solution:

```
#include <iostream>
#include <limits> // Include the header for numeric_limits

int main() {
    int num;
    // std::cout << "Enter an integer: ";
    if (!(std::cin >> num)) {
        std::cout << "Invalid input. Please enter an integer." << std::en
        std::cin.clear(); // Clear the error flag
        std::cin.ignore(std::numeric_limits<std::streamsize>::max(), '\n'
    } else {
        std::cout << "You entered: " << num << std::endl;
    }
    return 0;
}
```

TestCases:

S.No	Inputs	Outputs
1	Hello	Invalid input. Please enter an integer.
2	-999999999999999999	Invalid input. Please enter an integer.
3	1234567890123456789	Invalid input. Please enter an integer.
4	0	You entered: 0
5	3.14	You entered: 3
6	abc	Invalid input. Please enter an integer.

White List:

Black List:

Question 3:

Write a program that finds the maximum element in an array of integers using library functions.

Input Format:

- The program expects the user to enter integers.
- There are no specific prompts for input.
- The user can enter as many integers as they want, and they can stop by entering a non-integer value.

Output Format:

- If the user enters valid integers, the program calculates and displays the maximum element among those integers.
- If the user doesn't enter any valid integers, it outputs "No valid integers entered."

Title for Question 3: Finds the maximum element in an array

Solution:

```
#include <iostream>
#include <vector>
#include <algorithm>

using namespace std; // Add this line to use the std namespace

int main() {
    vector<int> arr;
    int num;

    // Prompt the user to enter integers until they decide to stop
    while (true) {
        //cout << "Enter an integer (or any non-integer to stop): ";
        if (cin >> num) {
            arr.push_back(num);
        } else {
            break; // Exit the loop if non-integer input is encountered
        }
    }

    if (!arr.empty()) {
        int maxElement = *max_element(arr.begin(), arr.end());
        cout << "Maximum element: " << maxElement << endl;
    } else {
        cout << "No valid integers entered." << endl;
    }

    return 0;
}
```

TestCases:

S.No	Inputs	Outputs
1	abc def ghi	No valid integers entered.
2	-1 -2 -3 -4 -5 -6 -7 -8 -9 -10	Maximum element: -1
3	100 -100 0 999 -999	Maximum element: 999
4	5 -10 15 -20 25	Maximum element: 25
5	0 0 0	Maximum element: 0
6	10 20 30 40 50 60 70 80 90 100	Maximum element: 100

White List:

Black List:

Question 4:

You are provided with a string str. Write a program to convert the first letter of each word in the string to uppercase.

Input Format:

- A single line containing a string str (1 <= |str| <= 1000), where |str| represents the length of the string. The string may contain spaces and consists of lowercase and uppercase English letters.

Output Format:

- A single line containing the modified string with the first letter of each word in uppercase.

Title for Question 4: Uppercase conversion

Solution:

```
#include <iostream>
#include <string>
#include <iomanip> // For setw

using namespace std;

int main() {
    string str;
    //cout << "Enter a string: ";
    getline(cin, str);

    bool newWord = true;

    for (int i = 0; i < str.length(); ++i) {
        if (isalpha(str[i])) {
            if (newWord) {
                if (str[i] >= 'a' && str[i] <= 'z') {
                    str[i] = str[i] - 'a' + 'A'; // Convert to uppercase
                }
                newWord = false;
            } else {
                if (str[i] >= 'A' && str[i] <= 'Z') {
                    str[i] = str[i] - 'A' + 'a'; // Convert to lowercase
                }
            }
        } else {
            newWord = true;
        }
    }

    cout << "Modified String:" << setw(2) << " " << str << endl;

    return 0;
}
```

TestCases:

S.No	Inputs	Outputs
1	hello world	Modified String: Hello World
2	This Is A Test	Modified String: This Is A Test
3	i aM aN exAmPle	Modified String: I Am An Example
4	123 456 789	Modified String: 123 456 789
5	apple BANANA chERry	Modified String: Apple Banana Cherry
6	aBcd Efgh Ijk	Modified String: Abcd Efgh Ijk

White List:

Black List:

Question 5:

Ritika has a coin of $N but she is the type of person who loves to have as much money as possible. A coin of $N can be exchanged in a bank into three coins of: $n/2, $n/3 and $n/4. But these numbers are all rounded down. Ritika decides to exchange her coin in the greed of money and makes profit. Your task is to find the maximum amount of money she can have at the end of exchange.

Input Format:

- The program takes a single input, which is a non-negative integer N representing the initial amount of money Ritika has. It reads this value from the standard input (cin).

Output Format:

- The program outputs a single line to the standard output (cout) that contains the maximum amount of money Ritika can have after exchanging coins.

Constraints:

1 <= N <= 10^{10}

Title for Question 5: Ritika's Money

Solution:

```
#include <iostream>

using namespace std;

// Function template to find the maximum amount of money Ritika can have
template <typename T>
T maximizeMoney(T N) {
    if (N <= 0) {
        return 0;
    }

    T maxMoney = N;

    T money1 = maximizeMoney(N / 2);
    T money2 = maximizeMoney(N / 3);
    T money3 = maximizeMoney(N / 4);

    maxMoney = max(maxMoney, money1 + money2 + money3);

    return maxMoney;
}

int main() {
    long long N;
    //cout << "Enter the initial amount: ";
    cin >> N;

    long long maxMoney = maximizeMoney(N);

    cout << "Maximum amount Ritika can have: $" << maxMoney << endl;

    return 0;
}
```

TestCases:

S.No	Inputs	Outputs
1	100	Maximum amount Ritika can have: $120
2	120	Maximum amount Ritika can have: $144
3	200	Maximum amount Ritika can have: $253
4	400	Maximum amount Ritika can have: $533
5	350	Maximum amount Ritika can have: $439
6	210	Maximum amount Ritika can have: $253

White List:

Black List:

Question 6:

Given an input stream of N integers. The task is to insert these numbers into a new stream and find the median of the stream formed by each insertion of X to the new stream.

Input Format:

- The first line contains an integer N, the number of elements in the stream.
- The next N lines contain the elements of the stream, one element per line.

Output Format:

- For each insertion of an element into the stream, the code calculates and prints the median of the current stream. The median is printed on a separate line.

Constraints:

1 <= N <= 10^6

1 <= x <= 10^6

Title for Question 6: Find the median of the stream

Solution:

```
#include <iostream>
#include <set> // Include the set header for multiset
#include <iterator> // Include the iterator header for advance

using namespace std;

int main() {
    int N;
    // cout << "Enter the number of elements in the stream: ";
    cin >> N;

    multiset<int> elements; // Multiset to store elements

    // cout << "Enter the elements in the stream:" << endl;
    for (int i = 0; i < N; i++) {
        int X;
        cin >> X;

        elements.insert(X); // Insert into the multiset

        // Calculate the median
        multiset<int>::iterator it = elements.begin();
        advance(it, i / 2); // Move iterator to the middle element

        if (i % 2 == 0) {
            cout << *it << endl;
        } else {
            cout << (static_cast<double>(*it) + *next(it)) / 2.0 << endl;
        }
    }

    return 0;
}
```

TestCases:

S.No	Inputs	Outputs
1	5 10 20 30 40 50	10 15 20 25 30
2	4 5 15 1 3	5 10 5 4
3	3 7 7 7	7 7 7
4	7 2 3 4 5 6 7 8	2 2.5 3 3.5 4 4.5 5
5	1 1000	1000
6	6 1 2 3 4 5 6	1 1.5 2 2.5 3 3.5

White List:

Black List:
