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NATIONAL UNIVERSITY
OF SCIENCES & TECHNOLOGY

SCHOOL OF MECHANICAL & MANUFACTURING ENGINEERING (SMME)
NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
SECTOR H-12, ISLAMABAD

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FOP ASSIGNMENT #01

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Question 1: Write a C++ program, take two strings as input from user and check if both strings are equal or not. If they are equal make them unequal by rotating string. e.g., Hello is turned into olleH etc.

Code:

```cpp
#include <iostream>

using namespace std;


int main()
{
    int string_count1 = 0, string_count2 = 0, i, j, k;
    char array1[100];
    char array2[100];

    cout << "Please enter the first string. (Enter 0 to end input): ";

    for (i = 0;; i++)
        {
            cin >> array1[i];
            if (array1[i] == '0')
                break;
            string_count2++;
        }
    cout << "Please enter the second string. (Enter 0 to end input): ";

    for (j = 0;; j++)
        {
            cin >> array2[j];
            if (array2[j] == '0')
                break;
            string_count1++;
        }

    if (string_count2 != string_count1)
            cout << "Not Equal";

    else
        {

            for (k = 0; k < string_count2; k++)
            {
                if (array1[k] != array2[k])
                    break;
            }
            if (k == string_count2)
            {
                for (int c = 0, d = string_count2 - 1; c < d; c++, d--)
                {
                    char temp = array1[c];
                    array1[c] = array1[d];
                    array1[d] = temp;
                }
                cout << endl;
                for (k = 0; k < string_count2; k++)
                {
                    cout << array1[k];
                }
                cout << endl;
            }
            else
                cout << "Not Equal";
        }

    return 0;
}
```

```
Please enter the first string. (Enter 0 to end input): Ateeq
0
Please enter the second string. (Enter 0 to end input): Ateeq
0

qeetA

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```

Question 2: Write a C++program for a string which may contain lowercase and uppercase characters. The task is to remove all duplicate characters from the string and find the resultant string.

Code:

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

using namespace std;

int main()
{
    string mixed_String;

    cout << "Enter a string: ";
    cin >> mixed_String;
    cout << endl;

    for (int i = 0; i < mixed_String.length(); ++i)
    {
        char letter = mixed_String[i];

        for (int j = i + 1; j < mixed_String.length();)
        {
            if (mixed_String[j] == letter)
                mixed_String.erase(j, 1);
            else
                ++j;
        }
    }

    cout << "The string after removing duplicates is: " << mixed_String << endl;

    return 0;

}
```

```
Enter a string: Worcestershire

The string after removing duplicates is: Worcesthi

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```

Question 3: Suppose an integer array a[5] = {1,2,3,4,5}. Add more elements to it and display them in C++.

Code:

```cpp
#include <iostream>

using namespace std;

int main()
{
    int array[5] = { 1,2,3,4,5 };
    int i, num_elements;

    cout << "The original array is:- " << endl;
    for (int i = 0; i < 5; ++i)
    {
        cout << array[i] << "\t";
    }
    cout << endl;
    cout << "Enter the number of elements you want to add in the given array: ";
    cin >> num_elements;
    cout << endl;

    cout << "Enter the new elements:- \n";

    for (i = 0; i < num_elements; ++i)
    {
        cin >> array[i + 5];
    }
    cout << endl;
    cout << "The updated array is:-" << endl;
    for (int i = 0; i < num_elements + 5; ++i)
    {
        cout << array[i] << "\t";
    }

    return 0;

}
```

```
The original array is:-
1       2       3       4       5
Enter the number of elements you want to add in the given array: 5

Enter the new elements:-
9
5
7
4
2

The updated array is:-
1       2       3       4       5       9       5       7       4       2
```

Question 4: Write a C++ program that uses a while loop to find the largest prime number less than a given positive integer N. Your program should take the value of N as input from the user and then find the largest prime number less than or equal to N. You are not allowed to use any library or pre-existing functions to check for prime numbers.

Code:

```cpp
#include <iostream>

using namespace std;

int main()
{
    int P_Num = 2, Num, count, i = 2, j;

    cout << "Enter an integer for which the largest prime number needs to be found: ";
    cin >> Num;
    cout << endl;

    while (i <= Num)
    {
        count = 0;
        j = 1;
        while (j <= i)
        {
            if (i % j == 0)
            {
                count++;
            }
            j++;
        }
        if (count == 2)
        {
            P_Num = i;
        }
        i++;
    }

    cout << "The largest Prime Number lesser than " << Num << " is: " << P_Num << endl;

    return 0;

}
```

```
Enter an integer for which the largest prime number needs to be found: 25

The largest Prime Number lesser than 25 is: 23

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```

Question 5: Implement Bubble Sort on an array of 6 integers

Code:

```cpp
#include <iostream>

using namespace std;

int main()
{
    int i;
    bool swapped;
    int array1[10] = {};

    cout << "Enter the elements of the array:- \n";
    for (i = 0; i < size(array1); ++i)
    {
        cin >> array1[i];
    }
    cout << endl;

    cout << "The array before sorting:- \n";
    for (int i = 0; i < size(array1); ++i)
    {
        cout << array1[i] << "\t";
    }
    cout << endl;

    for (i = 0; i < size(array1) - 1; ++i)
    {
        swapped = false;
        for (int j = 0; j < size(array1) - 1 - i; ++j)
        {
            if (array1[j] > array1[j + 1])
            {
                swap(array1[j], array1[j + 1]);
                swapped = true;
            }
        }
        if (swapped = false)
            break;
    }

    cout << "The array after sorting (in ascending order):- " << endl;
    for (int i = 0; i < size(array1); ++i)
    {
        cout << array1[i] << "\t";
    }
    cout << endl;

    return 0;

}
```

```
Enter the elements of the array:-
6
8
4
10
8
7
4
1
5
9

The array before sorting:-
6       8       4       10      8       7       4       1       5       9
The array after sorting (in ascending order):-
1       4       4       5       6       7       8       8       9       10

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```

Question 6: Solve any Aerospace/Real Life Problem using C++ Programming

Code:

```cpp
#include <iostream>
#include <cmath>

using namespace std;

float rel_length(float length, float velocity)
{
    const int speed_light = 299792458;
    float contract_length;

    contract_length = (sqrt(1 - ((pow(velocity, 2) / pow(speed_light, 2))))) / length;

    return contract_length;
}

float rel_mass(float mass, float velocity)
{
    const int speed_light = 299792458;
    float contract_mass;

    contract_mass = mass / (sqrt(1 - ((pow(velocity, 2) / pow(speed_light, 2)))));

    return contract_mass;
}

float rel_time(int time_elapsed, float velocity)
{
    const int speed_light = 299792458;
    float dil_time;

    dil_time = time_elapsed / (sqrt(1 - ((pow(velocity, 2) / pow(speed_light, 2)))));

    return dil_time;
}

int main()
{
    float length, length_c, mass, mass_c, velocity, time, time_d;
    int choice;

    cout << "Welcome aboard the spaceship. You may select from the given to know your stats \n";
    cout << "Select 1 for finding out your relativistic length \n";
    cout << "Select 2 for finding out your relativistic mass \n";
    cout << "Select 3 for finding out your time dilation \n";
    cout << endl;
    cin >> choice;
    cout << endl;

    while (choice != 1 && choice != 2 && choice != 3)
    {
        cout << "Enter a correct number: ";
        cin >> choice;
    }

    cout << "Enter the velocity of the spaceship: ";
    cin >> velocity;
    while (velocity <= 0 || velocity >= 299792458)
    {
        cout << "Enter a correct value for velocity: ";
        cin >> velocity;
    }

    if (choice == 1)
    {
        cout << "Enter the original length of the spaceship: ";
        cin >> length;
        length_c = rel_length(length, velocity);
        cout << endl;
        cout << "The spaceship has a relativistic length of " << length_c << " length units" << endl;;
    }
    if (choice == 2)
    {
        cout << "Enter the original mass of the spaceship: ";
        cin >> mass;
        mass_c = rel_mass(mass, velocity);
        cout << endl;
        cout << "The spaceship has a relativistic mass of " << mass_c << " mass units" << endl;
    }
    if (choice == 3)
    {
        cout << "Enter the original/rest/proper time elapsed of the spaceship: ";
        cin >> time;
        time_d = rel_time(time, velocity);
        cout << endl;
        cout << "The spaceship has a time dilation of " << time_d << "time units" << endl;;
    }

    return 0;

}
```

```
Welcome aboard the spaceship. You may select from the given to know your stats
Select 1 for finding out your relativistic length
Select 2 for finding out your relativistic mass
Select 3 for finding out your time dilation

9

Enter a correct number: -7
Enter a correct number: 2
Enter the velocity of the spaceship: 0
Enter a correct value for velocity: 398781533
Enter a correct value for velocity: 216464647
Enter the original mass of the spaceship: 85400

The spaceship has a relativistic mass of 123438 mass units

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```

Question 6 (Another attempt)
Code:

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

using namespace std;


string encrypt(string test_string, int num)
{
    string enc_string = "";
    for (char letter : test_string)
    {
        if (isalpha(letter))
        {
            if (isupper(letter))
            {
                enc_string = enc_string + char((letter - 'A' + num) % 26 + 'A');
            }
            else
            {
                enc_string = enc_string + char((letter - 'a' + num) % 26 + 'a');
            }
        }
        else
        {
            enc_string = enc_string + letter;
        }
    }
    return enc_string;
}

string decrypt(string test_string, int num)
{

    return encrypt(test_string, -num);
}

int main()
{
    string word;
    int Num, choice;

    cout << "Enter a word: ";
    cin >> word;

    cout << "Select 1 for Encryption or 2 for Decryption: ";
    cin >> choice;

    while (choice != 1 && choice != 2)
    {
        cout << "Enter a correct choice: ";
        cin >> choice;
    }

    if (choice == 1)
    {
        cout << "Enter the encryption shift number (from 0 - 25): ";
        cin >> Num;
        while (Num < 0 || Num > 25)
        {
            cout << "Enter the correct encryption shift number (from 0 - 25): ";
            cin >> Num;
        }
        cout << endl;
        cout << "The encrypted word is: " << encrypt(word, Num) << endl;
    }
    if (choice == 2)
    {
        cout << "Enter the decryption shift number (from 0 - 25): ";
        cin >> Num;
        while (Num < 0 || Num > 25)
        {
            cout << "Enter the correct encryption shift number (from 0 - 25): ";
            cin >> Num;
        }
        cout << endl;
        cout << "The decrypted word is: " << decrypt(word, Num) << endl;
    }

    return 0;
}
```

```
Enter a word: Programming
Select 1 for Encryption or 2 for Decryption: 9
Enter a correct choice: 0
Enter a correct choice: 1
Enter the encryption shift number (from 0 - 25): 56
Enter the correct encryption shift number (from 0 - 25): -7
Enter the correct encryption shift number (from 0 - 25): 6

The encrypted word is: Vxumxgssotm

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```