

**Note: Implement at least 6 tasks in the Lab.**  
**Remaining tasks can be done from home[its your choice].**

**Exercise:**

1. You are tasked with creating a C++ function that swaps the elements between two variables. Implement a recursive function named `recursiveSwap` that takes two variables as parameters and recursively swaps their values.
2. The every even integer greater than 2 has the property that it is the sum of two prime numbers. Like, For the even number 8, the pair is (3, 5) because  $3 + 5 = 8$ . For 12, the pair (5 + 7 = 12. Similarly, for 28, one pair is (5, 23) because  $5 + 23 = 28$ , and another is (11, 17) because  $11 + 17 = 28$ . Create a function named `find_pair(int, int)` that take two even integer as parameter and then finds the pairs of prime number of every even numbers between that range whose difference is minimal(the minimal difference in this context refers to the smallest absolute difference between the two primes in a pair that sums up to the given even number). Let you pass the `find_conjecture(700, 724)` then the output of your program might look like this:

```
Every even number greater than 2 is the sum of two primes (minimizing difference):
700: 347 + 353
702: 349 + 353
704: 337 + 367
706: 353 + 353
708: 349 + 359
710: 337 + 373
712: 353 + 359
714: 347 + 367
716: 349 + 367
718: 359 + 359
720: 353 + 367
722: 349 + 373
724: 293 + 431
```

Explanation: Note the following pairs of prime number but they have no minimal difference but you have to consider the minimal difference like above

700: 17 + 683

702: 11 + 691

704: 3 + 701

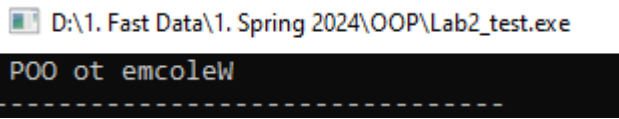
1098: 5 + 1093

1100: 3 + 1097

3. Write a recursive function to print the reverse of a given string. Do not use the Loop . You can use recursion.

**Example : str: Welcome to OOP**

**Output :**

 D:\1. Fast Data\1. Spring 2024\OOP\Lab2\_test.exe

POO ot emcoleW

4. Imagine you are tasked with creating a program to manage a library's book inventory. Each book has attributes such as title, author, publication year, and genre. Design a struct that effectively represents a book as a real-world entity. Then, write a simple program in a language of your choice that utilizes this struct to demonstrate the creation, modification, and display of book information.
- Extend the program to manage multiple books in an array.
  - Implement a function to search for a book by title or author.
  - Allow the user to input new books and update existing book information interactively.
5. You are given an array of integers and a target sum. Your task is to implement a recursive function in C++ that determines if there exists a subset of the array whose elements add up to the given target sum.
- Write a recursive function named `hasSubsetSum` that takes an array of integers, the array's size, and a target sum as input and returns a boolean indicating whether there exists a subset with the given sum.
  - The function signature should be: `bool hasSubsetSum(int arr[], int size, int targetSum)`.
6. You are tasked with implementing a simple Student Registration System in C++. Define two structures, `Register` and `Student`, where `Register` contains attributes `courseId` and `courseName`, and `Student` inherits from `Register` while having additional attributes such as `studentId`, `firstName`, `lastName`, `cellNo`, and `email`. Your goal is to create an array of `Student` structures to store information for five students. Write a C++ program that accomplishes the following tasks:
1. Implement the `Register` and `Student` structures.
  2. Inherit the `Register` structure in the `Student` structure.
  3. Create an array of `Student` structures to store information for 5 students.
  4. Take input for each student, including their `courseId`, `courseName`, `studentId`, `firstName`, `lastName`, `cellNo`, and `email`.
  5. Display the information for all 5 students.
7. You are tasked with building a simple product management system for an online store.
1. Create a function that allows the addition of a new product to the system. The function should take parameters such as product name, price, quantity, and any other relevant details.
  2. Implement a function that takes a product ID as input and displays detailed information about the product, including its name, price, quantity in stock, and any other relevant details.
  3. Design a function that enables the update of product information. It should take a product ID as well as the new details (e.g., updated price, quantity, etc.) and modify the existing product's information accordingly.
  4. Create a function that removes a product from the system based on its product ID. Ensure that the inventory is updated after the removal.

8. You are required to write a C++ program that will create a function named unique that will take array as input. The array may contain duplicate values but you have to process on the array and have to return the array which must contain only unique values not duplicates.

```
Enter the size of the array: 7
Enter the elements of the array:
5
2
5
3
2
1
8
Unique elements in the array are: 5 2 3 1 8
```

9. You are required to write a C++ function swap\_string that shifts the last n characters of a string to the front n times. It will take str and int as parameters. And will return the new string after shifting.

```
Enter a string: WELCOME
Enter the number of characters to shift: 2
Shifted string after shifting last 2 characters: MEWELCO
```

Hint: You can use substr() function. It is used to extract a substring from a given string, starting from a specified position and extending for a specified number of characters (or until the end of the string if the second parameter is not provided).

string substr (size\_t pos, size\_t len) const;

pos: The position of the first character to include in the substring. This position is 0-based, meaning the first character of the string is at position 0.

len: The length of the substring to extract. It's optional. If not specified, the function returns the substring starting from pos to the end of the string.

The substr() function returns a new string object that contains the extracted substring.