OBJECT ORIENTED PROGRAMMING

GROUP ASSIGNMENT SUBMISSION

Group:03

S. No	Tasks	Members
	RELATIONSHIPS:	
1	Composition	• Khadeeja Arshad Ali (B20102057) • Dua Ashraf (B20102031)
2	Inheritance	• Ahmed Ali (B20102013) • Urooba Shameem (B20102180)
3	Association	• Mariya Suleman (B20102065) • Sarah Rafiq Shaikh (B20102144)
4	Aggregation	• Nabiha Faisal (B20102130) • Jannat Rashid Paracha (B20102055)
	RECURSION AND FIBONACCI SERIES:	
5	Application and code conversion	• Muhammad Amas (B20102077) • Zunain Ali Azam (B20102183)

Q1(a): What is recursion?

RESCURSION:

Recursion is a programming approach in which a function or algorithm runs itself one or more times until a specific condition is fulfilled, at which point the remainder of each repeat is processed from the last to the first.

Q1(b): What is recursive relation for the Fibonacci series?

The Fibonacci numbers' recurrence connection is a second-order recurrence, which means it involves the preceding two values. It's also linear homogeneous, which means each term is made up of a constant multiplied by a sequence value.

Q2: Explore applications of Fibonacci sequence?

APPLICATIONS OF FIBONACCI SEQUENCE:

1. FIBONACCI SEQUENCE IN NATURE:

Fibonacci can be found in nature not only in the famous rabbit experiment, but also in beautiful flowers. On the head of a sunflower and the seeds are packed in a certain way so that they follow the pattern of the Fibonacci sequence. This spiral prevents the seed of the sunflower from crowding themselves out, thus helping them with survival. The petals of flowers and other plants may also be related to the Fibonacci sequence in the way that they create new petals

a) **Petals On Flowers:**

Probably most of us have never taken the time to examine very carefully the number or arrangement of petals on a flower. If we were to do so, we would find that the number of petals on a flower that still has all of its petals intact and has not lost any, for many flowers is a Fibonacci number.

- 1 petal: white cally lily.
- 3 petals: lily, iris.
- 5 petals: buttercup, wild rose, larkspur, columbine (aquilegia).
- 8 petals: delphiniums.
- 13 petals: ragwort, corn marigold, cineraria.

b) Spiral:

The Fibonacci numbers are found in the arrangement of seeds on flower heads. There are 55 spirals spiraling outwards and 34 spirals spiraling inwards in most daisy or sunflower blossoms. Pinecones clearly show the Fibonacci spirals. Fibonacci spiral can be found in cauliflower. Inside the fruit of many plants, we can observe the presence of Fibonacci order.

c) **Organs of human body:**

Humans exhibit Fibonacci characteristics. Every human has two hands, each one of these has five fingers and each finger has three parts which are separated by two knuckles. All of these numbers fit into the sequence. Moreover, the lengths of bones in a hand are in Fibonacci numbers.

2. FIBONACCI SEQUENCE IN CONVERTING KILOMETERS TO MILES:

The ratio of the Fibonacci numbers is very close to the Golden Ratio, 1.618034. Since 1 mile is roughly 1.609 kilometers, this is very close to the Golden Ratio. You can calculate miles from kilometers by shifting the register down in the Fibonacci sequence.

3. FIBONACCI IN CODING:

Recently Fibonacci sequence and golden ratio are of great interest to the researchers in many fields of science including high energy physics, quantum mechanics, cryptography and coding. Similar application of Fibonacci in Cryptography is described here by a Simple Illustration. Suppose that Original Message," CODE" to be Encrypted. It is sent through an unsecured channel. Security key is chosen based on the Fibonacci number. Any one character may be chosen as a first security key to generate cipher text and then Fibonacci sequence can be used. Agarwal et al (2015) used Fibonacci sequence for encryption data.

Q3: Write a technical comment on comparison of recursive approach and iterative approach in Fibonacci series?

Ans: The Fibonacci Series is a common programming issue, and we may get the series (or nth Fibonacci number) using both iterative and recursive methods. We'll analyse and contrast these strategies, as well as their complications, in this piece.

In recursive approach, if $n > 1$ then $F(n) = F(n-1) + F(n-2)$, each recursion would call two more making the Time Complexity Exponential.

It's self-evident that the iterative technique is the fastest and most memory-efficient because we just save the last two numbers.