FIBONACCI NUMBERS

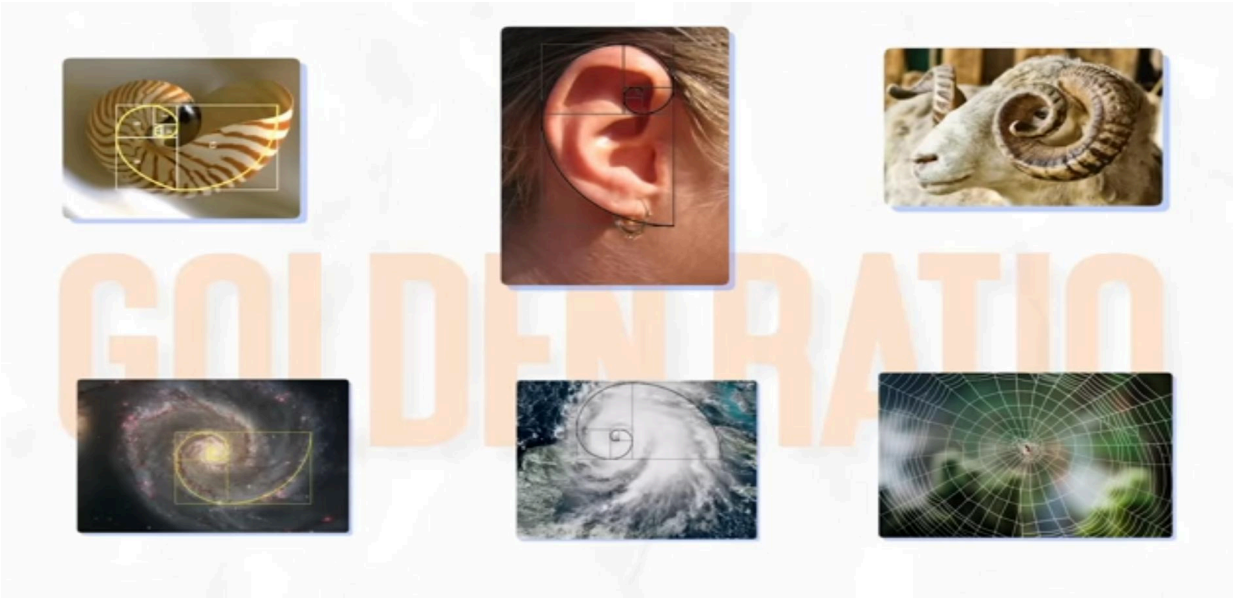
It may sound strange to hear that the magical numbers named as Fibonacci Numbers appear in Mathematics, Computer sciences. But these are not only the part of mathematics or computer science but also the part of Biology, Quantum Physics, Art, Architecture, Music as well and many more.

GOLDEN RATIO: 1.6180

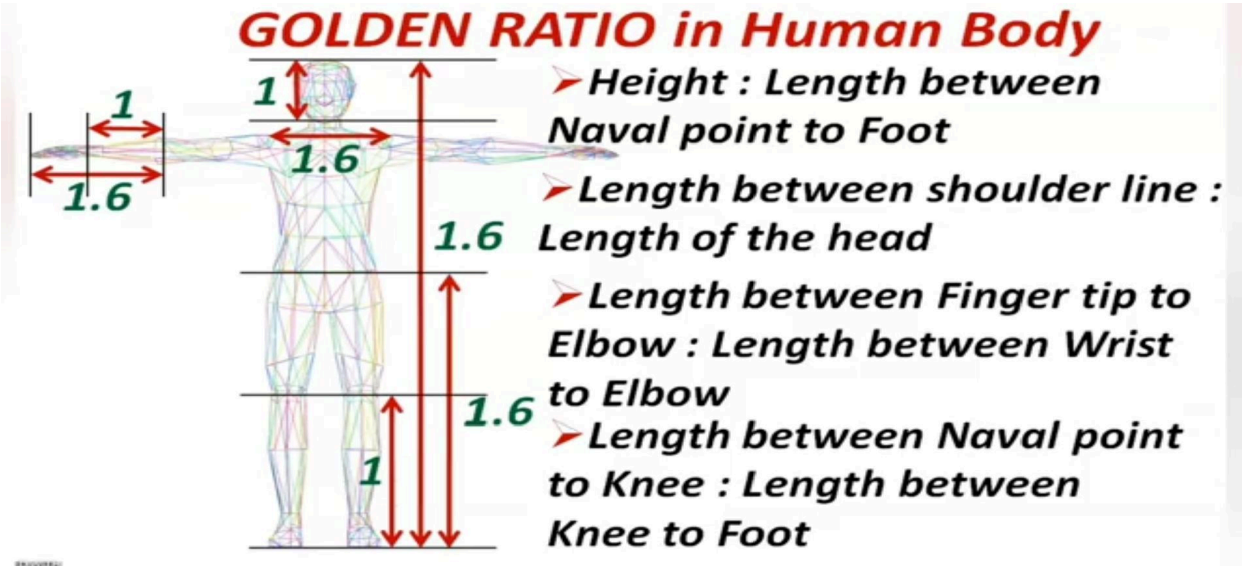
FIBONACCI NUMBER	DIVIDED BY THE ONE BEFORE	RATIO
5	5/3	1.66
8	8/5	1.60
13	13/8	1.62
21	21/13	1.61
34	34/21	1.61
55	55/34	1.61

The architects use this ratio in designing buildings. The photographs are also captured with respect to this ratio. This ratio is also used In medical for example plastic surgeries. Not only here many programmers and coders use this ratio for their project management.

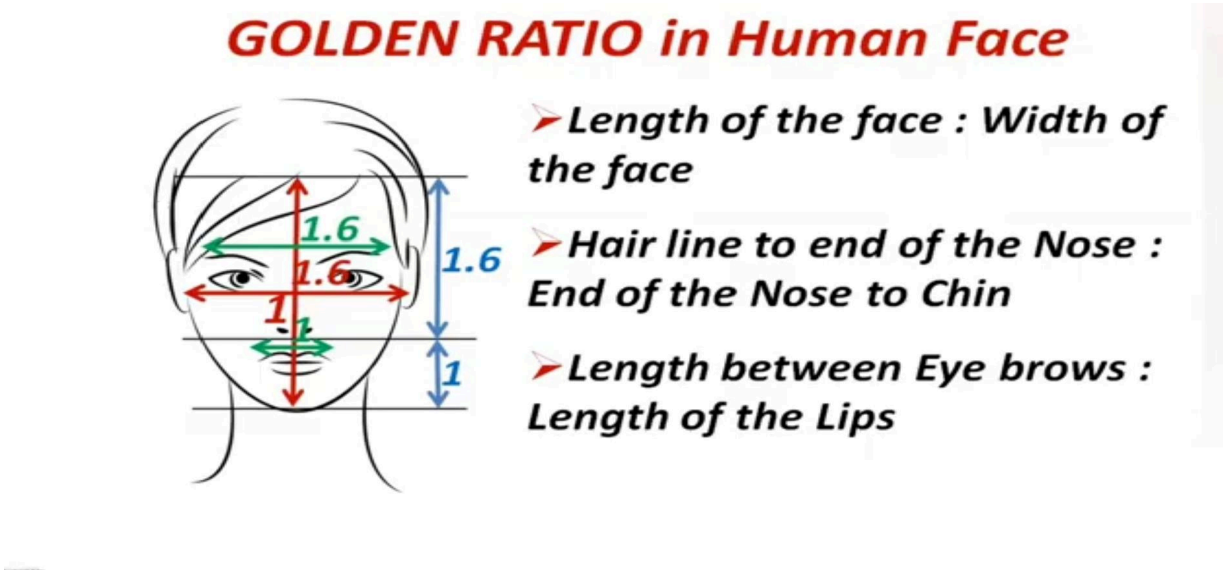
Below are some other examples of Fibonacci Golden Ratio.



IN HUMAN BODY

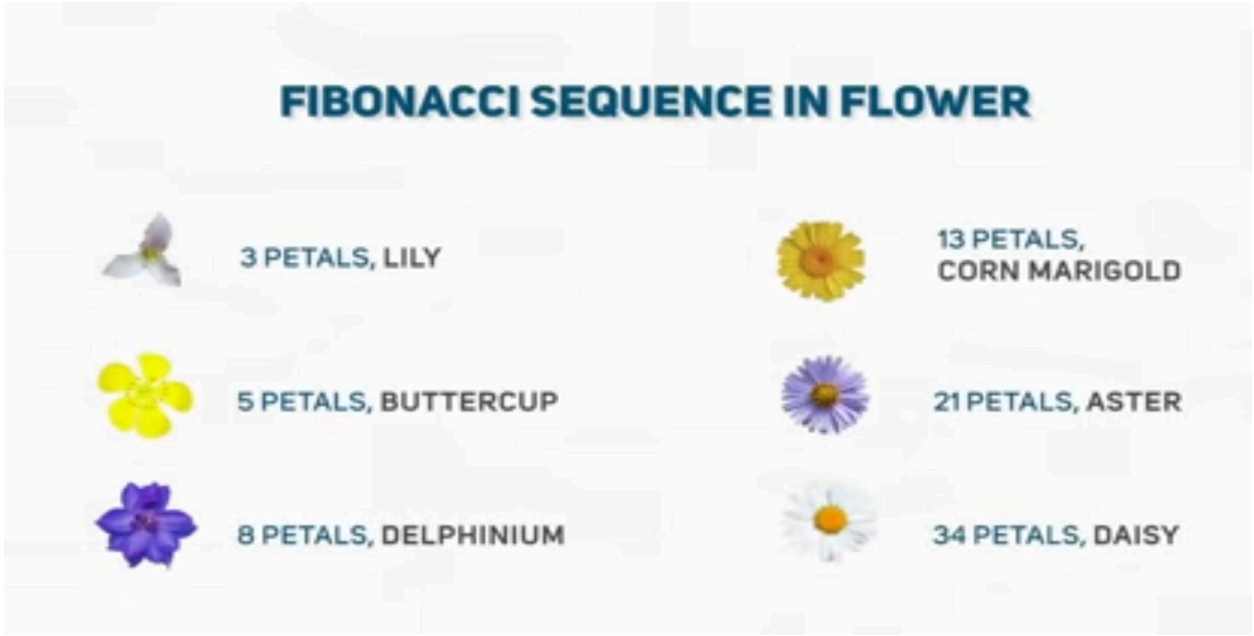


IN HUMAN FACE

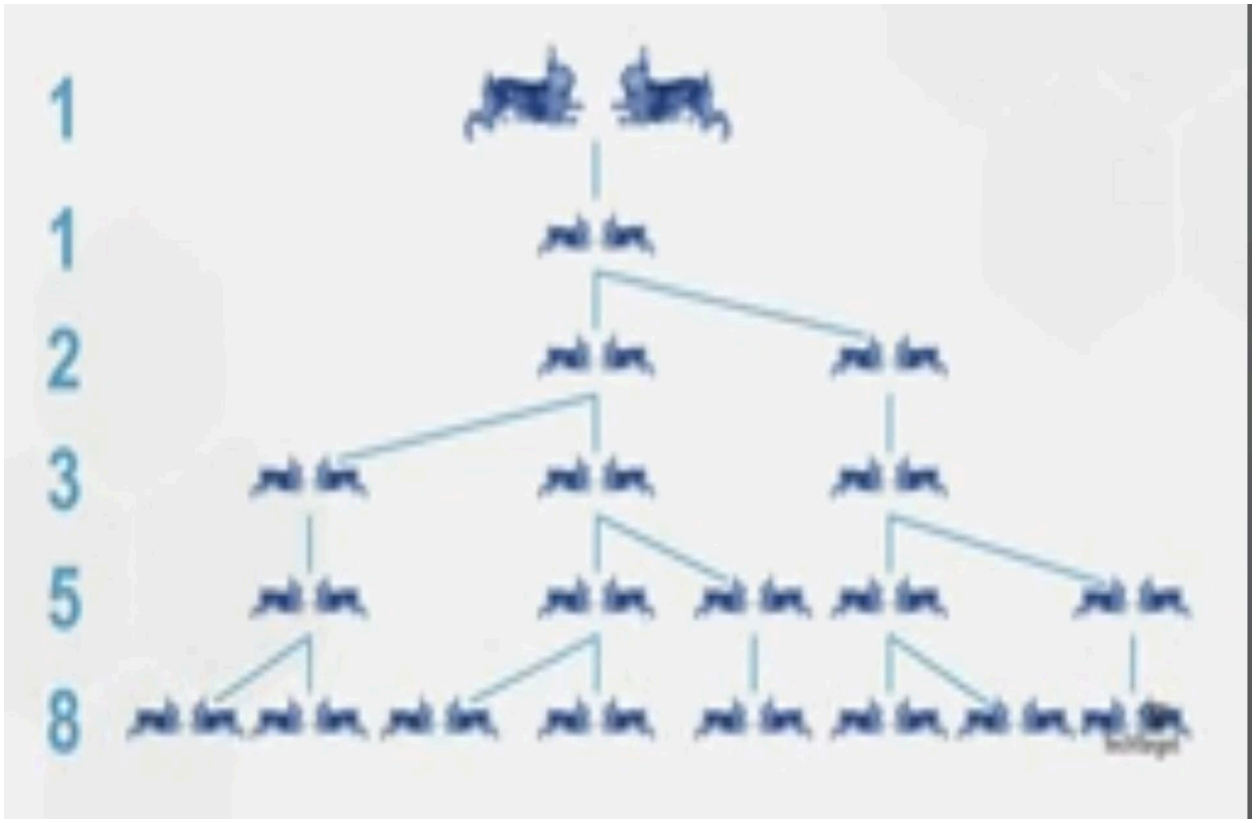


These numbers can be seen many times in Nature. As Flower Petals, Even our body parts also exists in Fibonacci numbers as we have 1 nose but 2 nostrils, 1 tongue, 1 heart, 1 liver, 1 stomach, 2 kidneys, 2 eyes, 2 hands, 2 feet, 2 lungs, 2 ears, 5 fingers in each hand, 5 toes in each foot, 1 brain but having 3 parts, etc. Even our DNA molecules also have Fibonacci sequence.

Flower Petals



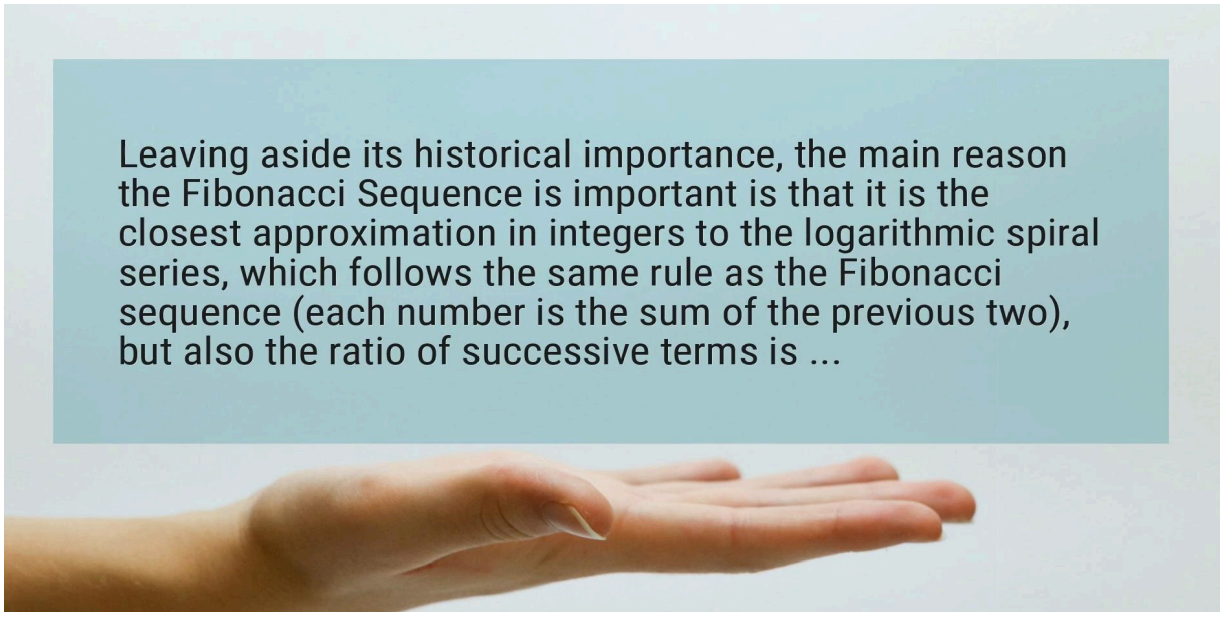
Rabbit Reproduction



Branches Of Trees

DISCOVERY

IMPORTANCE



RECURSION:
https://youtu.be/LrQjMY0eWC0?si=orsnY5oPMQ5RpZP7

MUSIC:
https://youtu.be/pOwMDOo-zBw?si=7JjSdEGKvxXuyehe

CODE:
From PF LAB 7 Problem 6 all parts.

FROM GPT

Fibonacci Facts:

1. Fibonacci numbers in Music:

Fibonacci sequences appear in musical compositions, such as Bach's fugues and Debussy's piano works.

2. Computer Science Applications:
Fibonacci numbers are used in algorithms for solving problems related to data compression, coding theory, and cryptography.

3. Physics Connections:
Fibonacci numbers appear in quantum mechanics, chaos theory, and the study of fractals.

4. Biological Growth Models:
Fibonacci numbers describe growth patterns in populations, such as rabbit populations.

5. Geometric Constructions:
Fibonacci numbers are used in geometric constructions, like the golden rectangle and golden triangle.

Related Mathematical Concepts:

1. Lucas Numbers:
A sequence similar to Fibonacci numbers, with different initial values.

2. Pascal's Triangle:
A triangular array of binomial coefficients, exhibiting Fibonacci-like properties.

3. Golden Angle:
The angle (137.5°) formed by the golden ratio, appearing in nature and art.

4. Fibonacci Polynomials:
Polynomials generalizing Fibonacci numbers, with applications in algebra and geometry.

5. Recurrence Relations:

Mathematical relationships defining sequences, like Fibonacci numbers.

6. Fractals:

Geometric shapes exhibiting self-similarity, often related to Fibonacci numbers.

7. Chaos Theory:

Study of complex, dynamic systems exhibiting Fibonacci-like patterns.

The Golden Ratio (φ) in Fibonacci numbers possesses unique properties, making it a fundamental element in mathematics, nature, and various fields.

Here are some powers of the Golden Ratio:

Mathematical Properties:

1. Irrationality:

φ = 1.61803398875... (non-repeating, non-terminating)

2. Transcendence:

φ is not a root of any polynomial equation with rational coefficients

3. Universality:

φ appears in numerous mathematical contexts (geometry, algebra, analysis)

Geometric Significance:

1. Golden Rectangle:

φ = (a + b) / a = a / b (perfect proportion)

2. Golden Triangle:

φ = (a + b) / a = c / b (balance and harmony)

3. Golden Spiral:

φ = (r / θ) = e^(π/2) (efficient growth and expansion)

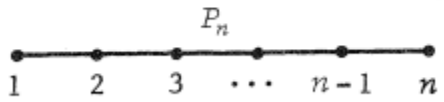
For a graph G, its Fibonacci number—simply denoted by F (G)—is defined as the number of subsets of V (G) in which no two vertices are adjacent in G, i.e. in graph-theoretical terminology, the number of independent sets of G, including the empty set.

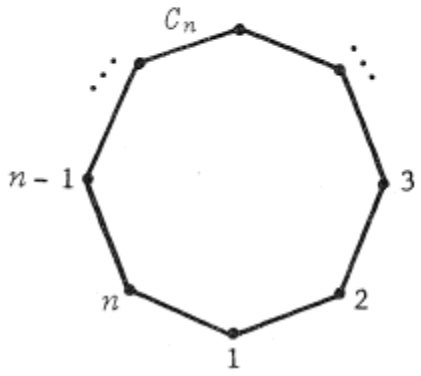
A Perfect Spiral is also know as Fibonacci Spiral.

Fruit: Bananas and apples when cut in half, not lengthwise, show ridges that appear in the fibonacci sequence, that is, 3 or 5, respectively. In flowers, plants, and trees, the pattern appears for several reasons, such as: To make use of the space for packaging and producing as many seeds as possible.

However, it is known that the golden ratio was officially discovered by Euclid around 300 BC. In the 1200s, Leonardo Fibonacci discovered the Fibonacci sequence, while Campanus demonstrated the irrationality of the Euclid's golden ratio

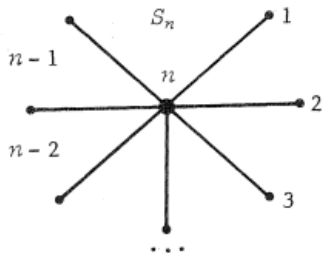
FIBONACCI NUMBERS OF GRAPHS

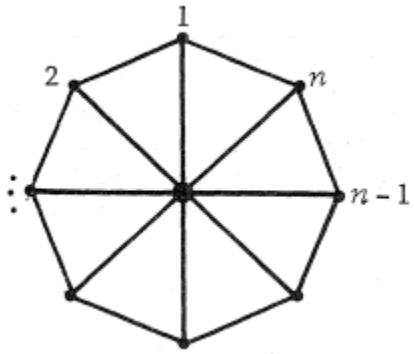


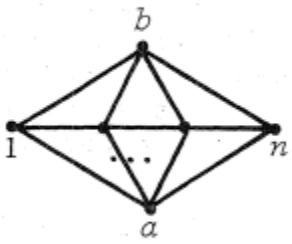


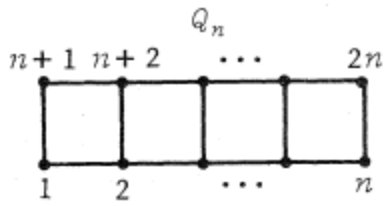
2. THE FIBONACCI NUMBERS OF TREES

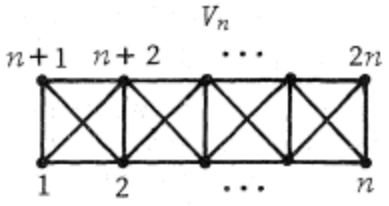
Trivially, the graph P_n is a tree with $f(P_n) = F_{n+1}$. Another simple example for a tree is the star S_n:

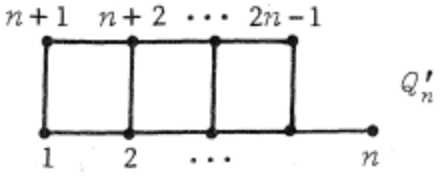


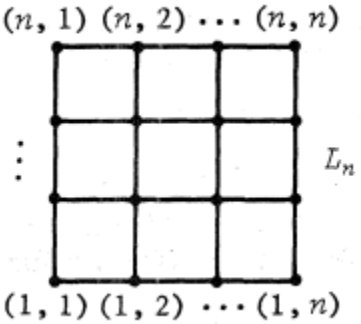


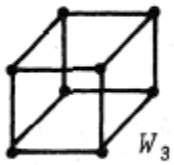


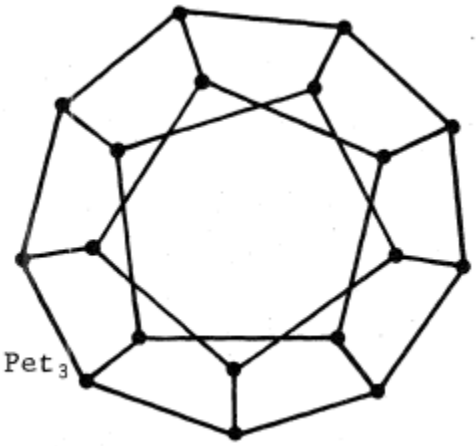

Q_n
$n+1$ $n+2$ $\cdots$ $2n$
1 2 $\cdots$ n


V_n
$n+1$ $n+2$ $\cdots$ $2n$
1 2 $\cdots$ n


$n+1$ $n+2$ $\cdots$ $2n-1$
Q'_n
1 2 $\cdots$ n


$(n, 1)$ $(n, 2)$ $\cdots$ (n, n)
L_n
$(1, 1)$ $(1, 2)$ $\cdots$ $(1, n)$


W_3


Pet_3