

**Sequential Search, Binary Search & Fibonacci sequence**

- 01.** You are helping a friend search for a book in their home library. The books are arranged by the author's last name, but not in any particular order (e.g., some authors might be out of order or grouped randomly).
  - I.** If you are looking for a book written by "Fitzgerald, F. Scott," how would you use a Sequential Search to find it? What steps would you take?
  - II.** Imagine the same books are now arranged in a perfectly sorted order by the author's last name. How would Binary Search help you find "Fitzgerald, F. Scott" more efficiently? Describe the steps involved..
- 02.** You have the following unsorted list of numbers: [23, 5, 17, 30, 8, 12, 45, 27, 3, 19].
  - I.** You need to find the number 27 using Sequential Search. How many comparisons will it take to find the number 27 in this list?
  - II.** You need to find the number 27 using Binary Search. How many comparisons will it take to find the number 27 in this sorted list?
- 03. *Read the following scenario and answer the given questions.***

Imagine you are a biologist studying the growth pattern of a new species of plant. You've noticed that the number of new branches that grow each month follows a pattern similar to the Fibonacci sequence. The Fibonacci sequence is a series of numbers where each number is the sum of the two preceding ones, starting from 0 and 1. The sequence goes as follows: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, and so on.

Your goal is to model this plant's growth pattern to predict future branch development and to plan the spatial and resource requirements for its growth. This involves calculating the number of branches for upcoming months and using search algorithms to analyze and visualize the data. You started observing the plant from the beginning of its growth cycle. You noted that in the first month, the plant has 1 branch. In the second month, it also has 1 branch. From the third month onward, the number of new branches each month follows the Fibonacci sequence.

You collect data over several months and find that the number of branches each month corresponds to Fibonacci numbers. For instance, in the 3rd month, the plant has 2 branches, in the 4th month it has 3 branches, in the 5th month it has 5 branches, and so on.

- I.** Using the Fibonacci sequence, calculate the number of branches for the 6th and 8th months.
- II.** If the biologist needs to plan space for the plant's growth and wants to know the total number of branches that will be present by the end of the 8th month, how many branches should they plan for?
- III.** If the pattern of branch growth continues as per the Fibonacci sequence, how many branches will there be in the 12th month?
- IV.** Calculate the average growth rate of branches per month between the 6th and 12th months.
- V.** Determine the total number of branches that will have grown from the 1st month to the 12th month.
- VI.** If another plant species follows a different sequence where each month's growth is the sum of the previous three months' branch counts, how many branches would this species have in the 6th month? Compare it with the number of branches in the 6th month of the Fibonacci sequence.
- VII.** Given that the growth rate is defined as the difference in the number of branches between consecutive months, determine the month in which the growth rate was highest between the 1st and 12th months.
- VIII.** Create a detailed simple Graph (or describe how you would create one) showing the number of branches from the 1st to the 12th month. Include a trend line or any patterns you observe in the growth over time.
- IX.** Given a list of Fibonacci numbers for the first 15 months, use Sequential Search to find the position of the 9th Fibonacci number. Describe the process and calculate the number of comparisons made.
- X.** Given a sorted list of Fibonacci numbers for the first 15 months, use Binary Search to find the position of the 144th Fibonacci number. Describe the process and calculate the number of comparisons made.
- XI.** If the biologist needs to find out in which month a specific number of branches (e.g., 144) will occur, explain how you would use both search algorithms to find this information. Discuss the advantages and disadvantages of each method.
- XII.** Use Binary Search to find the range of months where the number of branches falls between two specific values, say between 21 and 233. Describe how you would implement this search and the steps involved.