



# Jump Search



Jump Search algorithm is a slightly modified version of the linear search algorithm. The main idea behind this algorithm is to reduce the time complexity by comparing lesser elements than the linear search algorithm.

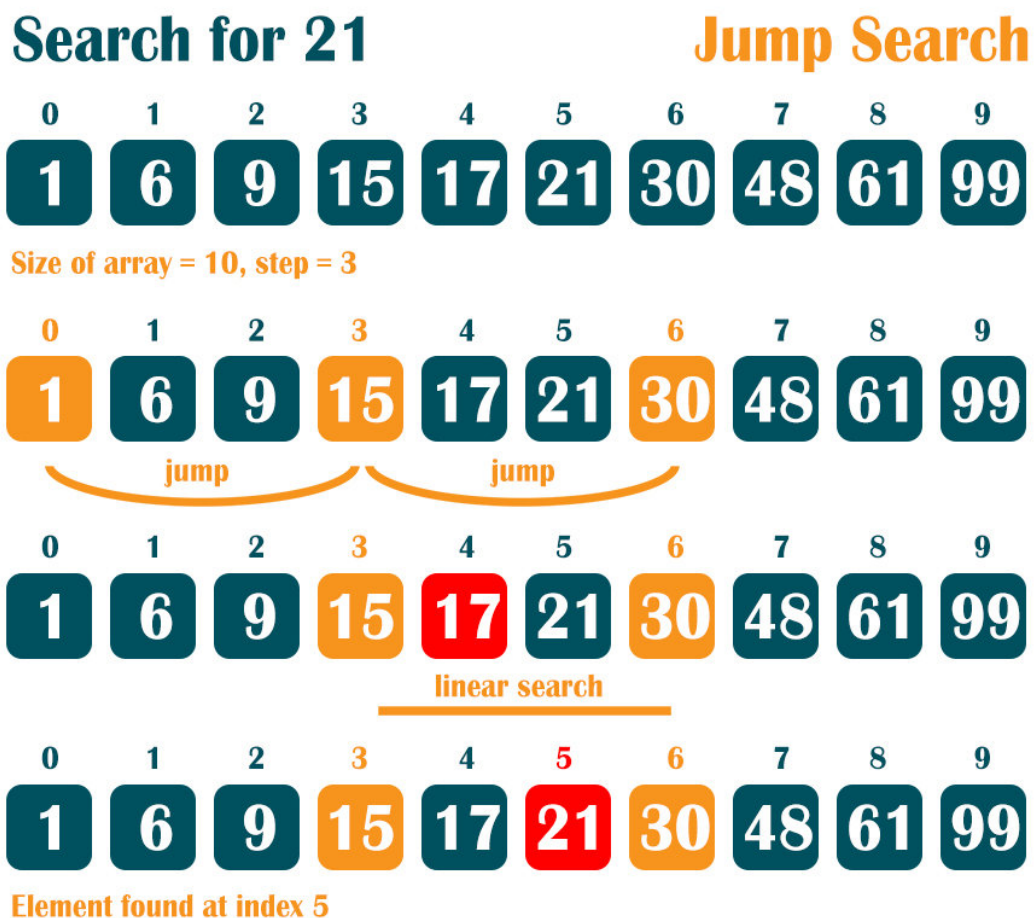
The input array is hence sorted and divided into blocks to perform searching while jumping through these blocks.

## Algorithm steps

- Jump Search is an algorithm for finding a specific value in a sorted array by jumping through certain steps in the array.
- The steps are determined by the  $\sqrt{n}$  of the length of the array.
- Here is a step-by-step algorithm for the jump search:
- Determine the step size  $m$  by taking the  $\sqrt{n}$  of the length of the array  $n$ .
- Start at the first element of the array and jump  $m$  steps until the value at that position is greater than the target value. Once a value greater than the target is found, perform a linear search starting from the previous step until the target is found or it is clear that the target is not in the array. If the target

is found, return its index. If not, return -1 to indicate that the target was not found in the array.

→ The **optimal jump size** is  $\sqrt{n}$ , where **n** is the size of the array to be searched or the total number of elements to be searched.



Jump search can be implemented only on a sorted list of items. If the elements are not sorted already, we need to sort them first.

## Pseudocode

```
Begin
    blockSize := √size
    start := 0
    end := blockSize
    while array[end] <= key AND end < size do
        start := end
        end := end + blockSize
        if end > size - 1 then
            end := size
        done
    for i := start to end - 1 do
        if array[i] = key then
            return i
        done
    return invalid location
End
```

## Analysis

- The time complexity of the jump search technique is  $O(\sqrt{n})$
- Performance comparison:
  - linear search < jump search < binary search

## Advantages of Jump Search

1. Better than a linear search for arrays where the elements are uniformly distributed.
2. Jump search has a lower time complexity compared to a linear search for large arrays.
3. The number of steps taken in jump search is proportional to the square root of the size of the array, making it more efficient for large arrays.
4. It is easier to implement compared to other search algorithms like binary search or ternary search.

5. Jump search works well for arrays where the elements are in order and uniformly distributed, as it can jump to a closer position in the array with each iteration.

## Disadvantages of Jump Search

- It is slower than binary search algorithm which searches an element in  $O(\log n)$
- It requires the input array to be sorted

## Real World Application of Jump Search

1. **Database Management Systems:** It is valuable for efficiently navigating sorted datasets in database management systems. Its application facilitates the swift retrieval of specific records within sorted databases, enhancing information retrieval processes.
2. **File Management Systems:** Within file systems, where files often organize themselves in a sorted fashion based on attributes like file names or creation dates, Jump Search emerges as a tool for expedited file location. Leveraging Jump Search optimizes file retrieval operations, contributing to improved system performance.
3. **Text Editing and Word Processing:** Text editors and word processors routinely employ sorted indexes for words or phrases within documents. By incorporating Jump Search, these applications streamline locating and editing specific content within documents, fostering efficient text manipulation.
4. **Web Search Engines:** Web search engines meticulously index web pages using keywords and other criteria. Integrating Jump Search into their indexing and retrieval mechanisms enables rapid identification of relevant web pages in response to user queries, thereby enhancing search engine efficiency.
5. **Scientific and Engineering Applications:** In scientific and engineering domains, Jump Search finds utility in sifting through sorted numerical datasets. Its implementation facilitates the precise location of specific data points or patterns within extensive datasets, supporting various data analysis and visualization tasks.

6. **Network Routing Systems:** In such cases, files often organize themselves in a sorted fashion based on attributes like file names or creation dates. Integrating Jump Search into network routers facilitates swift and efficient navigation of routing tables, aiding in determining the optimal next hop for packet forwarding.
7. **Genetic Research:** Genetic sequencing databases categorize genetic information based on genetic markers in sorted order. Leveraging Jump Search in genetic research enables the swift identification of specific genetic sequences or patterns within these databases, thereby supporting gene discovery and analysis endeavors.
8. **Digital Libraries:** Digital libraries meticulously organize digital resources such as books, articles, and multimedia files based on metadata attributes. By incorporating Jump Search, digital libraries expedite locating resources in response to user queries, enriching user experience and facilitating seamless information access.



Java implementation can be found under Implementation\_Java folder

## References

### Jump Search Algorithm

Jump Search Algorithm - Jump Search algorithm is a slightly modified version of the linear search algorithm. The main idea behind this algorithm is to reduce the time complexity

 [https://www.tutorialspoint.com/data\\_structures\\_algorithm/jump\\_search\\_algorithm.htm](https://www.tutorialspoint.com/data_structures_algorithm/jump_search_algorithm.htm)



tutorialspoint

### Jump Search in C++

Jump Search is an algorithm used to find a value in an ordered array of elements. Its main purpose is to do as few searches as possible. In order to do that it starts from the

wix <https://oanaunciuleanu.wixsite.com/artofcoding/post/jump-search-in-c>



## Jump Search - GeeksforGeeks

A Computer Science portal for geeks. It contains well written, well thought and well explained computer science and programming articles, quizzes and practice/competitive

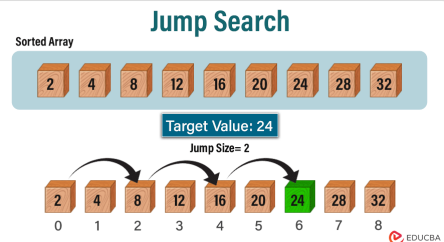
↻ <https://www.geeksforgeeks.org/jump-search/>



## Jump Search: Applications, Examples & How to Works

Jump Search is an algorithm for efficiently searching sorted arrays, balancing simplicity and efficiency for various real-world applications.

↻ <https://www.educba.com/jump-search/>



## Jump Search Algorithm | Studytonight

Jump Search Algorithm is a relatively new algorithm for searching an element in a sorted array. This tutorial covers Jump search algorithm in details with examples and program.

🖼️ <https://www.studytonight.com/data-structures/jump-search-algorithm>

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## SerhatKumas - Overview

Computer engineering student who loves coding in different fields instead of focusing on a one spesific area. -

SerhatKumas

🌐 <https://github.com/SerhatKumas>

