1. Introduction to Searching

1.1 What is Searching?

Searching is the process of finding a particular element or checking if an element exists in a data structure (array, linked list, tree, etc.).

Real-World Analogies:

- Finding a book in a library
- Searching for a contact in your phone
- Looking up a word in a dictionary
- Finding a file on your computer

Types of Searching:

1. **Linear Search** - Sequential search through elements
2. **Binary Search** - Divide and conquer approach (requires sorted data)
3. **Jump Search** - Jumping ahead by fixed steps
4. **Interpolation Search** - Improved binary search for uniformly distributed data
5. **Exponential Search** - Finding range then binary search

Note: There's actually a lot more searching algorithms, but we'll focus on the most common ones.

1.2 Why Study Searching Algorithms?

Importance:

- One of the most common operations in programming
- Critical for database queries
- Essential for data retrieval systems
- Foundation for more complex algorithms
- Performance impact on large datasets

Performance Metrics:

- **Best Case:** Minimum number of comparisons
- **Average Case:** Expected number of comparisons
- **Worst Case:** Maximum number of comparisons
- **Space Complexity:** Extra memory required

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