Linear Search and Binary Search

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Linear Search Example

- **Problem**: Find book ID 42 in shelf: [23, 15, 42, 19, 7].
- Check each book from left to right.
- **Step-by-Step**:
  1. Check 23: Not 42.
  2. Check 15: Not 42.
  3. Check 42: Found at position 3.

Linear Search

- Check each element until target is found or list ends.
- Simple but slow for large lists.
- **Time Complexity**: $O(n)$ (worst/average case).
- **Space Complexity**: $O(1)$.

Binary Search Example

- **Problem**: Find page 42 in sorted catalog: [10, 20, 30, 40, 42, 50, 60].
- Check middle, narrow to left or right half.
- **Step-by-Step**:
  1. Middle: 40. 42 ¿ 40, search [42, 50, 60].
  2. Middle: 42. Found at position 5.

Binary Search

- Requires sorted list. Divide search range in half each step.
- Compare middle element, recurse on appropriate half.
- **Time Complexity**: $O(\log n)$.
- **Space Complexity**: $O(1)$ (iterative version).