Welcome to this CoGrammar Tutorial:

Recursion, Sorting and Searching

The session will start shortly...

Questions? Drop them in the chat. We'll have dedicated moderators answering questions.

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Software Engineering Session Housekeeping

- The use of disrespectful language is prohibited in the questions, this is a supportive, learning environment for all - please engage accordingly. **(Fundamental British Values: Mutual Respect and Tolerance)**
- No question is daft or silly - **ask them!**
- There are **Q&A sessions** throughout this session, should you wish to ask any follow-up questions.
- If you have any questions outside of this lecture, or that are not answered during this lecture, please do submit these for upcoming Academic Sessions. You can submit these questions here: [Questions]

Software Engineering Session Housekeeping cont.

- For all **non-academic questions**, please submit a query: **www.hyperiondev.com/support**
- Report a **safeguarding** incident: **www.hyperiondev.com/safeguardreporting**
- We would love your **feedback** on lectures: **Feedback on Lectures**
- If you are hearing impaired, please kindly use your computer's function through Google chrome to enable captions.

Safeguarding & Welfare

We are committed to all our students and staff feeling safe and happy; we want to make sure there is always someone you can turn to if you are worried about anything.

If you are feeling upset or unsafe, are worried about a friend, student or family member, or you feel like something isn't right, speak to our safeguarding team:

Ian Wyles
Designated Safeguarding Lead

Simone Botes

Nurhaan Snyman

Rafiq Manan

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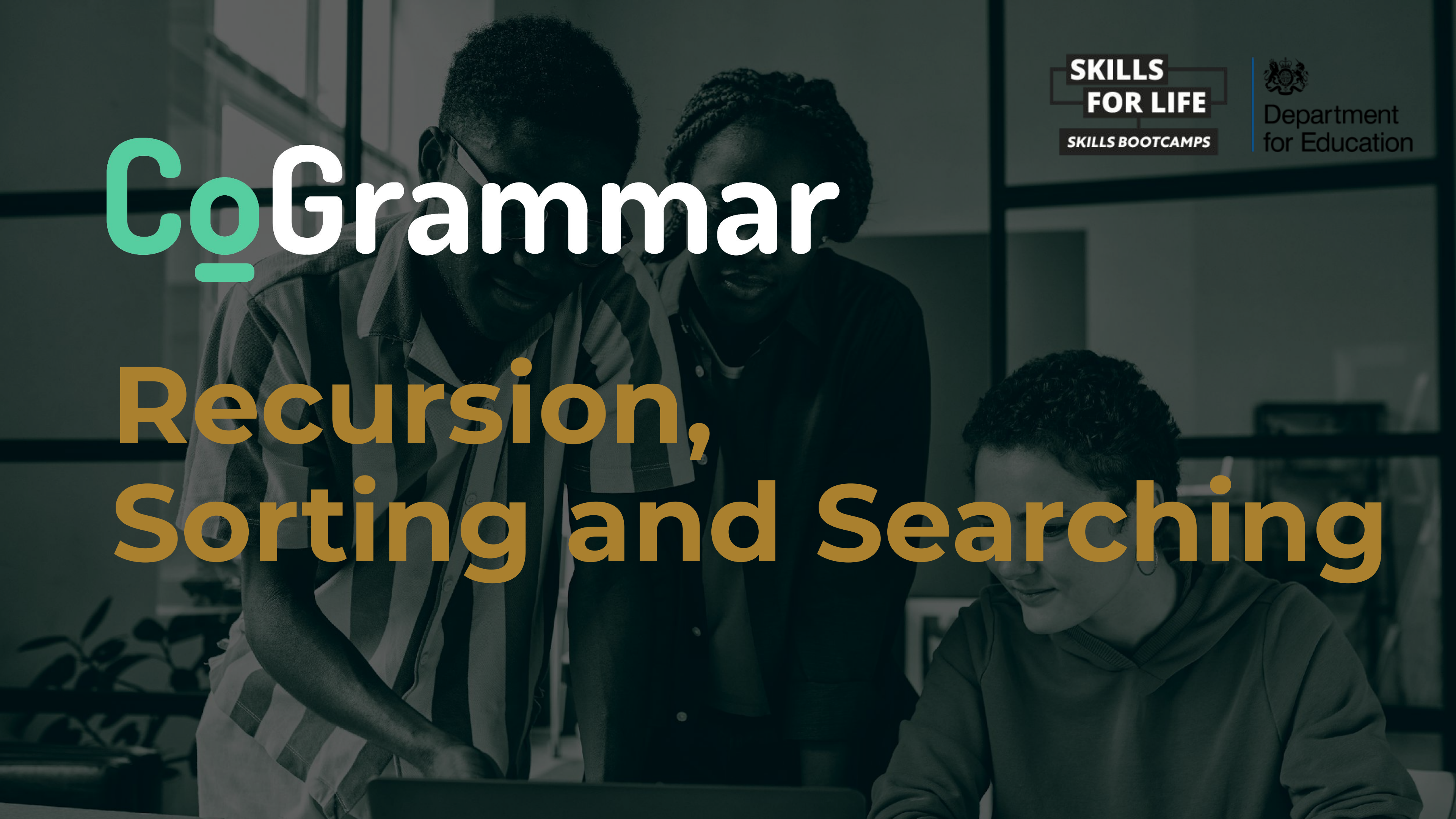

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Recursion, Sorting and Searching

Learning Outcomes

- Define recursion and identity a recursion problem
- Implement recursion for basic problems like factorial or binary search
- Predict stack overflow from ill-formed recursion
- Describe based sorting algorithms and their associated complexities: Bubble and insertion sort
- Describe basic searching algorithms and their associated complexities: Linear and Binary Search

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Recursion

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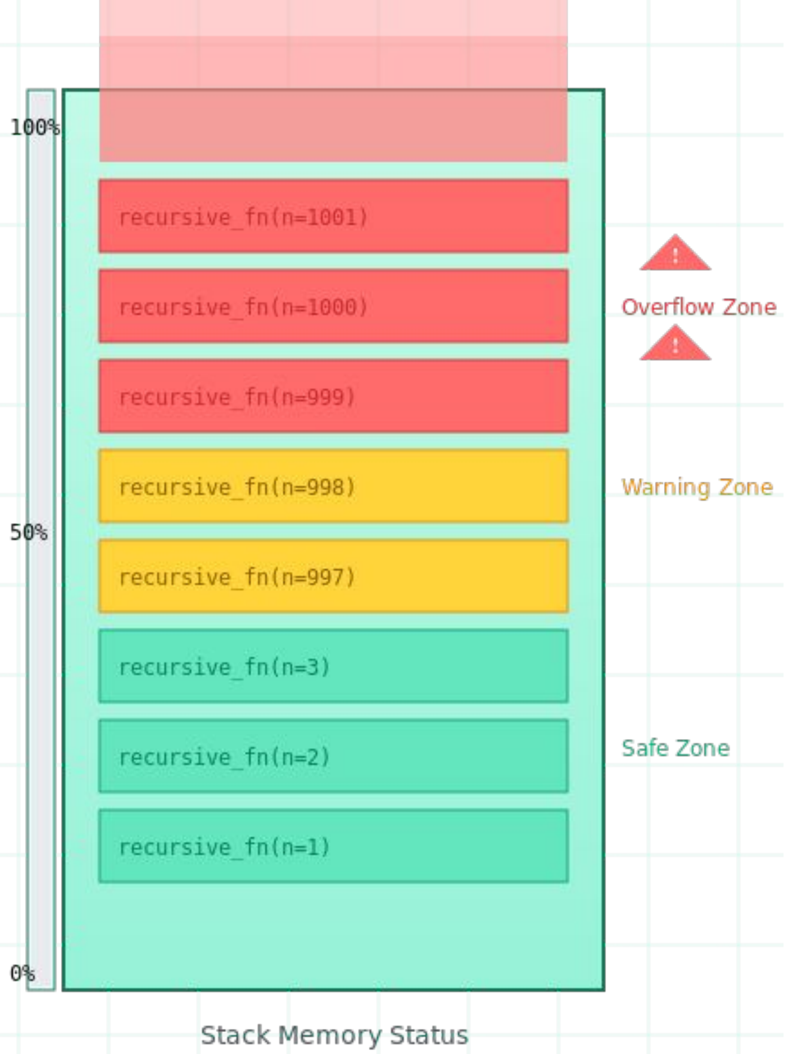
Recursion and Iterations

- Recursion is a programming technique where a function calls itself to solve a problem by breaking it down into smaller, similar sub-problems.
- Iteration is a fundamental programming concept that involves repeating a set of instructions or a process multiple times until a specific condition is met.

Types of iterations

- **Count-controlled Iterations**
  - Where the number of repetitions is predetermined based on a fixed count or iteration variable.
- **Sentinel-controlled Iteration**
  - Where the loop continues executing until a specific value known as the "sentinel" is encountered, ie. -1 to exit or EOF.
- **Condition-controlled Iterations**
  - Where the repetition continues until a specific condition evaluates to false.

Stack Overflow



Sorting

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Data Structures and Algorithms

- A data structure is a specialised format for organising, processing, retrieving and storing data.

  Eg: **Tree, List, Stacks, Queues**

- An algorithm is a set of commands that must be followed for a computer to perform calculations or other problem-solving operations.

  Eg: **Searching, Sorting**

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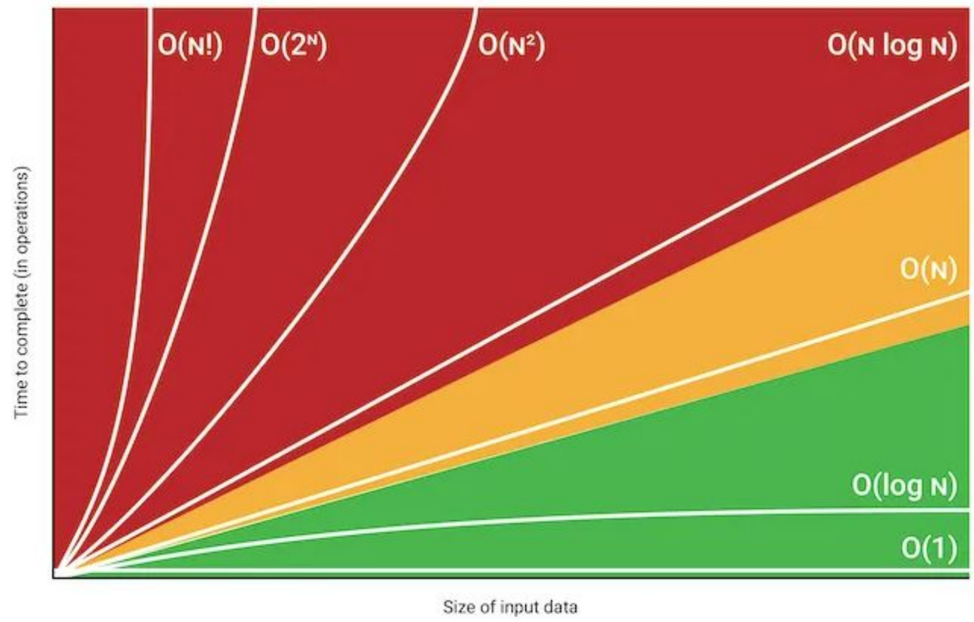
Order of Complexity

- Order of complexity, time complexity or Big-O Notation is the performance or efficiency of an algorithm as the size of its input grows.
- It focuses on the growth rate of the running time or space usage, rather than the exact time, making it possible to compare the efficiency of different algorithms.

Order of Complexity



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Sorting Algorithms Definition

- A Sorting Algorithm is used to rearrange a given array or list of elements according to a comparison operator on the elements.

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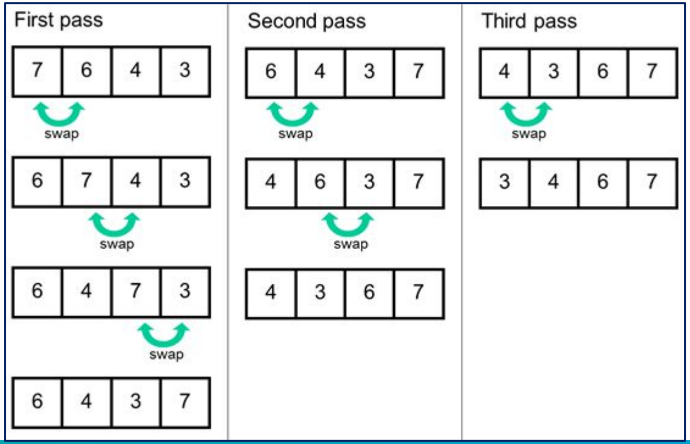
Sorting Algorithms - Bubble

- **Bubble sort** is a simple sorting algorithm that repeatedly steps through the list, compares adjacent elements, and swaps them if they are in the wrong order, continuing until the list is sorted.



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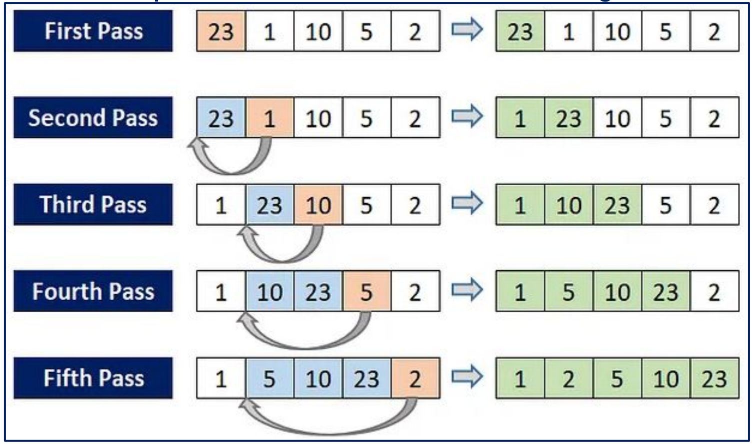
Sorting Algorithms - Insertion

- **Insertion sort** is a sorting algorithm that builds the final sorted array one item at a time by repeatedly taking the next element and inserting it into the correct position in the already sorted part of the array.



Sorting Algorithms - Selection

- **Selection sort** is a sorting algorithm that repeatedly selects the minimum element from the unsorted portion of the array and swaps it with the first unsorted element, gradually building up a sorted array from left to right.

First Pass	1	10	23	-2	⇨	-2	10	23	1
Second Pass	-2	10	23	1	⇨	-2	1	23	10
Third Pass	-2	1	23	10	⇨	-2	1	10	23
Fourth Pass	-2	1	10	23	⇨	-2	1	10	23

Searching

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Searching Algorithms Definition

- **Searching algorithms** are essential tools in computer science used to locate specific items within a collection of data.

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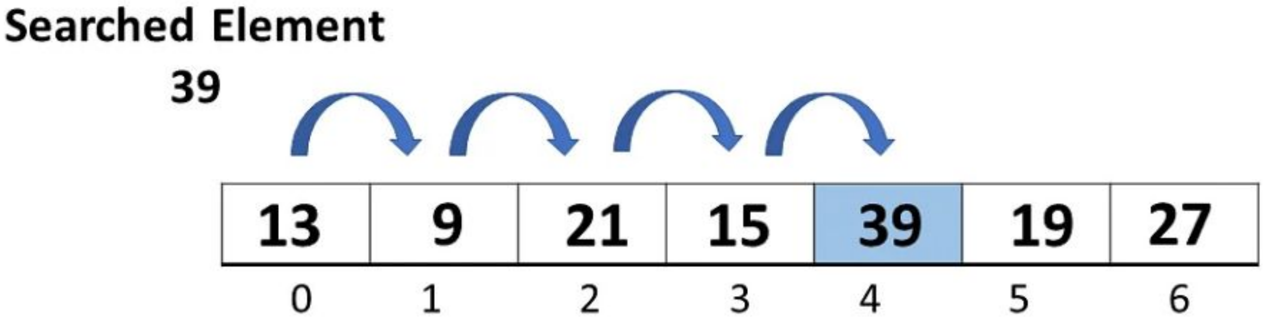
Searching Algorithms - Linear

- **Linear search** is a simple search algorithm that sequentially checks each element in a list until the target element is found or the end of the list is reached. No sorting is required.



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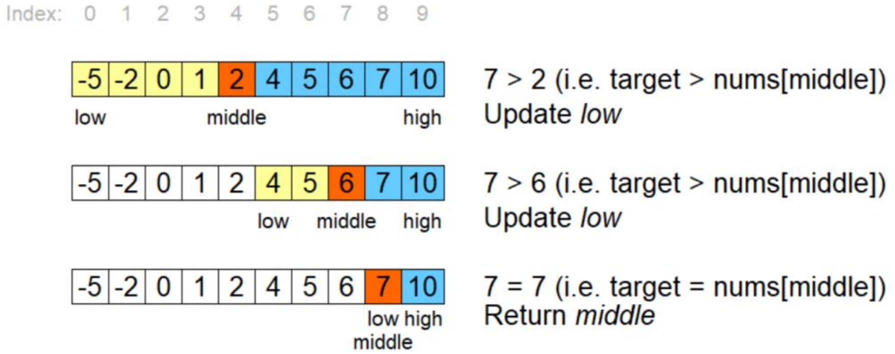
Searching Algorithms - Binary

- **Binary search** is a search algorithm that efficiently locates a target value within a sorted array by repeatedly dividing the search interval in half and comparing the target value to the middle element, eliminating half of the remaining elements each time.



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Thank you for attending

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