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In computer science, data structures are fundamental concepts that are crucial for organizing and storing data efficiently. Among the various data structures, stacks and queues are two of the most basic yet essential structures used in programming and algorithm design. Despite their simplicity, they form the backbone of many complex systems and applications. This article provides the differences between stack and queue data structures, exploring their characteristics, operations, and use cases. StacksA stack is a linear data structure that follows the Last In, First Out (LIFO) principle. This means that the last element added to the stack is the first one to be removed. It can be visualized as a pile of plates where you can only add or remove the top plate. Operations on Stack:The primary operations associated with a stack are: Push: Adds an element to the top of the stack.Pop: Removes and returns the top element of the stack.Peek (or Top): Returns the top element of the stack without removing it.IsEmpty: Checks if the stack is empty.Size: Returns the number of elements in the stack.Use Cases of Stack:Stacks are used in various applications, including: Function Call Management: The call stack in programming languages keeps track of function calls and returns.Expression Evaluation: Used in parsing expressions and evaluating postfix or prefix notations.Backtracking: Helps in algorithms that require exploring all possibilities, such as maze solving and depth-first search.QueuesA queue is a linear data structure that follows the First In, First Out (FIFO) principle. This means that the first element added to the queue is the first one to be removed. It can be visualized as a line of people waiting for a service, where the first person in line is the first to be served. Operations on Queue:The primary operations associated with a queue are: Enqueue: Adds an element to the end (rear) of the queue.Dequeue: Removes and returns the front element of the queue.Front (or Peek): Returns the front element of the queue without removing it.IsEmpty: Checks if the queue is empty.Size: Returns the number of elements in the queue.Use Cases of Queue:Queues are used in various applications, including: Task Scheduling: Operating systems use queues to manage tasks and processes.Breadth-First Search (BFS): In graph traversal algorithms, queues help in exploring nodes level by level.Buffering: Used in situations where data is transferred asynchronously, such as IO buffers and print spooling.Key Differences Between Stack and QueueHere is a table that highlights the key differences between stack and queue data structures: FeatureStackQueueDefinitionA linear data structure that follows the Last In First Out (LIFO) principle.A linear data structure that follows the First In First Out (FIFO) principle.Primary OperationsPush (add an item), Pop (remove an item), Peek (view the top item)Enqueue (add an item), Dequeue (remove an item), Front (view the first item), Rear (view the last item)Insertion/RemovalElements are added and removed from the same end (the top).Elements are added at the rear and removed from the front.Use CasesFunction call management (call stack), expression evaluation and syntax parsing, undo mechanisms in text editors.Scheduling processes in operating systems, managing requests in a printer queue, breadth-first search in graphs.ExamplesBrowser history (back button), reversing a word.Customer service lines, CPU task scheduling.Real-World AnalogyA stack of plates: you add and remove plates from the top.A queue at a ticket counter: the first person in line is the first to be served.Complexity (Amortized)Push: O(1), Pop: O(1), Peek: O(1)Enqueue: O(1), Dequeue: O(1), Front: O(1), Rear: O(1)Memory StructureTypically uses a contiguous block of memory or linked list.Typically uses a circular buffer or linked list.ImplementationCan be implemented using arrays or linked lists.Can be implemented using arrays, linked lists, or circular buffers.ConclusionStacks and queues are fundamental data structures that serve different purposes based on their unique characteristics and operations. Stacks follow the LIFO principle and are used for backtracking, function call management, and expression evaluation. Queues follow the FIFO principle and are used for task scheduling, resource management, and breadth-first search algorithms. Understanding the differences between these two data structures helps in selecting the appropriate one for specific applications, leading to more efficient and effective programming solutions. In computer science, data structures are fundamental concepts that are crucial for organizing and storing data efficiently. Among the various data structures, stacks and queues are two of the most basic yet essential structures used in programming and algorithm design. Despite their simplicity, they form the backbone of many complex systems and applications. This article provides the differences between stack and queue data structures, exploring their characteristics, operations, and use cases. 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Stack and queue both are linear data structures that you will use in many challenging situations. But, to understand when to use which data structure, you must first understand the variance between both these data structures What Is Stack? Stack in data structure in computer science is similar to stack as a method of arranging items in the real world. Stack is a linear data structure similar to arrays and linked lists, restricting the random access of elements. In arrays or linked lists, you can access the items via traversal or random indexing, but the stack data structure doesn't allow it either. A stack can be best understood by seeing it as a container of pieces that can only be stacked on top of each other and removed from that same direction only. Stack as a data structure in computer science is similar to stack as a method of arranging items in the real world. A stack can be represented as a set of books piled on top of each other. These books can only be placed on each other from the top end. This scenario illustrates sequential book access, which is equivalent to the stack data structure in computer science. The image given below represents the stack as a real-life example: Moving forward in the topic of Stacks and Queues, you will understand the Representation of Stacks. Representation of Stacks The stack data structure follows Last In First Out or First In Last Out principles to execute its operations. In simpler words, the stack data structure removes the last inserted element at first from the topmost position and the first inserted element at last. That is why this data structure only requires one pointer to remember the element at the top position Basic Operations on Stacks Both Stacks and Queues can perform some of the fundamental operations, like storing and manipulating the data elements. Now, you will understand the functions of the stack. You can perform some basic operations on the stacks, they are: push(arg): The components are added at the top of the stack during this process. You must give an element to the Push() method that you wish to place into a stack. Push operation involves the following steps: Step 1: Checks if the stack is complete or not. Step 2: If the stack is complete, it will exit and produce an overflow condition. Step 3: If the stack is not complete, it increments the top by one and points to the next space. Step 4: Adds data element to that space Step 5: Returns as a success Algorithm of the Push Operation: begin :stack, data_element If the stack is full return null end if top