# Smart Irrigation System Optimizer

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## Problem Being Solved

The Smart Irrigation System Optimizer simulates farm component management by handling irrigation requests, managing drought emergencies, logging water usage, tracking faulty components, and scheduling urgent maintenance activities using efficient data structures.

## Key Objectives

- Queue-based management of irrigation sensor requests.  
- Stack-based urgent drought response handling.  
- Array-based logging system for recent water usage.  
- Singly and doubly linked lists for maintenance tracking.  
- Circular linked list for managing high-priority urgent fixes.

## Design Explanation

The following data structures were used for their operational suitability:  
- Queue ensures fair and sequential handling of irrigation requests.  
- Stack ensures last drought alerts are handled first.  
- Array efficiently tracks recent activities while minimizing memory overflow.  
- Singly linked list dynamically tracks leaky components.  
- Doubly linked list allows bidirectional inspection of fixed components.  
- Circular linked list allows continuous monitoring of high-priority maintenance tasks.

## Efficiency of Data Structures

The queue and stack ensure quick and fair request handling. Arrays provide a simple yet effective method for fixed-size recent logging. Linked lists allow dynamic memory allocation for varying maintenance tasks. Circular linked lists ensure no reinitialization is needed for repeated high-priority task management.

## Logic of the Code

The program simulates a full irrigation system cycle:  
- Irrigation requests are queued and transferred to a stack for urgent watering.  
- Water usage is logged with automatic oldest-log removal.  
- Faulty components are tracked and repaired with linked lists.  
- Emergency fixes are managed in a cyclic manner without service interruptions.

## Variables and Functions Used

- Structures: Node (Singly Linked List), DNode (Doubly Linked List), CNode (Circular Linked List).  
- Arrays: reqQueue, droughtStack, usageLog.  
- Functions: pushToQueue, popFromQueue, addEmergency, handleEmergency, addToUsageLog, showUsageLogs, addLeaky, fixComponent, showFixedForward, showFixedBackward, addUrgent, cycleUrgentTwice.