*Comsats University Islamabad, Wah Campus*



Data Structures and Algorithms

Projects

December 7, 2024

# ->**3D Tic-Tac-Toe**

* **Description**: Develop a 3D version of Tic-Tac-Toe using 3D arrays for gameplay.
* **DSA Concepts**: 3D arrays for managing game states.
* **Real-Life Use**: Enhancing traditional games with multidimensional logic.

1. **Music Playlist Manager**

* **Description**: Create a music playlist manager to add, remove, and shuffle songs.
* **DSA Concepts**: Linked lists for dynamic playlist management.
* **Real-Life Use**: Applications like Spotify or Apple Music.

1. **Expression Evaluator**

* **Description**: Build an infix to postfix expression converter and evaluator.
* **DSA Concepts**: Stacks for expression parsing and evaluation.
* **Real-Life Use**: Mathematical expression solving in calculators.

1. **Undo-Redo Functionality**

* **Description**: Implement undo and redo functionality for a text editor.
* **DSA Concepts**: Stacks to track changes.
* **Real-Life Use**: Word processors like Microsoft Word or Google Docs.

1. **Text Editor**

* **Description**: Create a basic text editor to manage lines of text dynamically.
* **DSA Concepts**: Linked lists for line storage and management.
* **Real-Life Use**: Simplified text processing tools.

1. **->File Compression Tool**

* **Description**: Develop a tool to compress and decompress files using Huffman coding.
* **DSA Concepts**: Huffman trees for encoding and decoding.
* **Real-Life Use**: File compression tools like WinRAR or 7-Zip.

1. **Library Book Tracker**

* **Description**: Manage book issuance and returns dynamically.
* **DSA Concepts**: Linked lists for book tracking.
* **Real-Life Use**: Library management systems.

1. **Visualization Tool**

* **Description**: Create a tool to visually demonstrate various sorting algorithms.
* **DSA Concepts**: Sorting algorithms and visualization techniques.
* **Real-Life Use**: Educational tools for teaching algorithms.

1. **Rank Calculation System**

* **Description**: Assign ranks to students or participants in a competition.
* **DSA Concepts**: Sorting algorithms for rank calculation.
* **Real-Life Use**: Ranking systems for exams or sports competitions.

1. **Spell Checker**

* **Description**: Check word validity using a dictionary. With each word calculate the total length of the word and store it in the node so that the property of BST does not get affected.
* **DSA Concepts**: Binary Search Tree (BST) for efficient lookup.
* **Real-Life Use**: Text editors with spell-check features.

1. **Movie Recommendation System**

* **Description**: Provide movie recommendations based on user input.
* **DSA Concepts**: BST Linked list for movie data storage.
* **Real-Life Use**: Platforms like IMDb or Netflix.

1. **Matrix Visualizer**

* **Description**: Visualize a matrix with interactive tools.
* **DSA Concepts**: Matrix operations and visual representations.
* **Real-Life Use**: Scientific and educational visualization tools.

1. **Merge k-Sorted Linked Lists**

* **Description**: Efficiently combine multiple sorted linked lists into one sorted linked list.
* **DSA Concepts**: Priority queue for efficient merging.
* **Real-Life Use**: Data merging in distributed systems.

1. **Height Balancer**

* **Description**: Convert a binary tree into an AVL tree.
* **DSA Concepts**: AVL tree rotations and balancing.
* **Real-Life Use**: Balanced data structures for optimized search.

1. **Sorting Visualizer with Trees**

* **Description**: Visualize sorting algorithms using tree-based representations.
* **DSA Concepts**: Tree structures and sorting algorithms.
* **Real-Life Use**: Algorithm teaching tools.

1. **Library Management System**

* **Description**: Create a library system combining stacks, queues, and BST.
* **DSA Concepts**: Mixed data structures for efficient operations.
* **Real-Life Use**: Comprehensive library management platforms.

1. **Memory Management System**

* **Description**: Allocate and deallocate memory blocks dynamically.
* **DSA Concepts**: Linked lists for memory tracking.
* **Real-Life Use**: Memory management in operating systems.

1. **Simulation of a Ticket Booking System**

* **Description**: Manage ticket booking requests using a queue.
* **DSA Concepts**: Queue for customer request handling.
* **Real-Life Use**: Ticket booking platforms like Ticketmaster.

1. **Contact Manager**

* **Description**: Manage and search for contacts efficiently.
* **DSA Concepts**: BST for contact storage and retrieval.
* **Real-Life Use**: Contact apps like Google Contacts.

1. **Dictionary Application**

* **Description**: Store and search for words in a dictionary.
* **DSA Concepts**: BST for word lookup.
* **Real-Life Use**: Dictionary applications.

# **Custom Comparator Sort**

* **Description**: Sort elements based on user-defined criteria.
* **DSA Concepts**: Custom comparator functions for sorting.
* **Real-Life Use**: Sorting features in e-commerce platforms like Amazon.

1. **Digital Calculator**

* **Description**: Develop a basic calculator to perform arithmetic operations.
* **DSA Concepts**: Stack for expression evaluation.
* **Real-Life Use**: Standard and scientific calculator apps.

1. **Car Rental System**

* **Description**: Manage car rentals, availability, and bookings.
* **DSA Concepts**: Queue for booking requests, BST for car management.
* **Real-Life Use**: Platforms like Hertz or Enterprise.

1. **Employee Management System**

* **Description**: Manage employee records dynamically.
* **DSA Concepts**: Linked lists and BST for storing and searching employee data.
* **Real-Life Use**: HR management systems.

1. **->Traffic Management System**

* **Description**: Simulate traffic flow and prioritize signals.
* **DSA Concepts**: Graphs for traffic routing, priority queues for congestion handling.
* **Real-Life Use**: Traffic simulation tools.

1. **Bank Management System**

* **Description**: Manage customer accounts, transactions, and queries.
* **DSA Concepts**: Linked lists for transactions, BST for account management.
* **Real-Life Use**: Core banking systems.

1. **Hotel Booking System**

* **Description**: Manage hotel bookings and room availability.
* **DSA Concepts**: Priority queue for room assignments, 2D array for room layouts.
* **Real-Life Use**: Booking platforms like Booking.com or Airbnb.

1. **Sales Management System**

* **Description**: Track and manage sales dynamically.
* **DSA Concepts**: Linked lists for sales data, heaps for top sales tracking.
* **Real-Life Use**: Sales and CRM software like Salesforce.

1. **Student Record Management System**

* **Description**: Store and manage student records efficiently.
* **DSA Concepts**: BST for record storage.
* **Real-Life Use**: School management software.

1. **Grocery Store Inventory**

* **Description**: Build an inventory system to track items based on expiry dates.
* **DSA Concepts**: BST for item categorization, heaps for expiry date sorting.
* **Real-Life Use**: Inventory systems in supermarkets.

1. **Movie Booking System**

* **Description**: Manage seat reservations with availability tracking.
* **DSA Concepts**: 2D array for seating, sorting algorithms for seat preference.
* **Real-Life Use**: Movie booking platforms like BookMyShow.

1. **Railway Reservation System**

* **Description**: Manage train seat reservations and waiting lists.
* **DSA Concepts**: Linked lists for waiting lists, 2D array for seating.
* **Real-Life Use**: Railway booking platforms like IRCTC.

1. **E-commerce Product Search**

* **Description**: Implement a system to search and sort products based on price and rating.
* **DSA Concepts**: BST for product storage, sorting algorithms for ranking.
* **Real-Life Use**: Product search in e-commerce platforms.

1. **Taxi Fare Calculator with Surge Pricing**

* **Description**: Calculate fares dynamically based on distance and demand.
* **DSA Concepts**: Min-heap for nearest rides, sorting for surge pricing.
* **Real-Life Use**: Ride-hailing services like Uber or Ola.

1. **Personal Finance Manager**

* **Description**: Manage daily expenses and categorize them for budgeting.
* **DSA Concepts**: AVL tree for transaction categorization, heap for highest expenses.
* **Real-Life Use**: Finance apps like Mint or YNAB.

1. **Emergency Medical Supplies Tracker**

* **Description**: Track and deliver medical supplies based on urgency.
* **DSA Concepts**: Priority queue for hospital requests.
* **Real-Life Use**: Emergency response systems in healthcare.

1. **Airline Ticket Management System**

* **Description**: Manage airline tickets by scheduling, availability, and cancellations.
* **DSA Concepts**: Priority queue for seat allocation, AVL tree for ticket details.
* **Real-Life Use**: Flight booking systems like Expedia.

1. **Fitness Center Schedule Manager**

* **Description**: Manage gym schedules and prioritize peak hours.
* **DSA Concepts**: Min-heap for prioritizing popular slots, linked list for schedule tracking.
* **Real-Life Use**: Gym management software.

# **E-Sports Team Draft System**

* **Description**: Simulate player drafting based on skills and team preferences.
* **DSA Concepts**: Max-heap for skill rankings, queue for drafting order.
* **Real-Life Use**: Sports and e-sports team management systems.

1. **Recipe Finder**

* **Description**: Search and suggest recipes based on user inputs and preferences.
* **DSA Concepts**: Tree for searching recipes, heap for trending recipes.
* **Real-Life Use**: Recipe platforms like BigOven.

1. **Dynamic Classroom Exam Scheduler**

* **Description**: Schedule exams dynamically based on class size and subject importance.
* **DSA Concepts**: Priority queue for subject importance.
* **Real-Life Use**: Educational management systems.

1. **->Fraudulent Document Detection**

* **Description**: Detect duplicate or altered documents in a database.
* **DSA Concepts**: Hashing for unique document identification, linked list for document history.
* **Real-Life Use**: Document verification systems.

1. **Game Matchmaking System**

* **Description**: Pair players for online matches based on skill levels.
* **DSA Concepts**: Priority queue for matchmaking, heap for top-ranked players.
* **Real-Life Use**: Gaming platforms like Steam.

1. **Class Attendance Tracker**

* **Description**: Track and report student attendance in real-time.
* **DSA Concepts**: Link list for attendance records, heap for frequently absent students.
* **Real-Life Use**: Educational management platforms.

1. **Movie Recommendation Engine**

* **Description**: Suggest movies based on watch history and ratings.
* **DSA Concepts**: BST for searching titles, heap for top-rated recommendations.
* **Real-Life Use**: Platforms like Netflix.

1. **Movie Theater Seat Allocator**

* **Description**: Dynamically allocate seats based on group size and preferences.
* **DSA Concepts**: AVL tree for seating arrangements.
* **Real-Life Use**: Cinema booking systems.

1. **Campus Security Alert System**

* **Description**: Prioritize and broadcast security alerts to the campus.
* **DSA Concepts**: Priority queue for alert severity.
* **Real-Life Use**: Campus safety systems.