Data Structure in Real Life

Hina Arora

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1D ARRAY

A one-dimensional (1D) array is linear collection of elements, where each element is accessed by a single index. Here are a few examples of hw 1D arrays are used in eal life:

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1. Telephone book

A telephone book uses a 1D array to store a list of names ad phone numbers. Each element in the array corresponds to a single entry in the book, which contins a name and a phone number.

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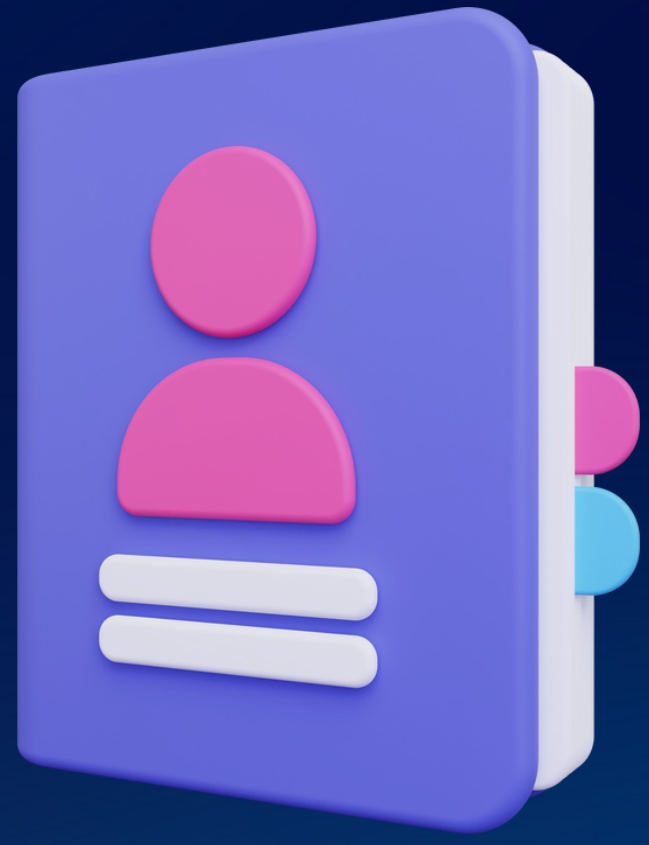

2. Barcode scanner

A barcode scanner uses a 1D array to store the sequence of black and white bars that make up a barcode. Each element in the array corresponds to a single bar in the barcode, with a value of 0 or 1 indicating whether the bar is white or black.

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3. Vending Machine

A vending machine uses a 1D array to store the amount of each item in stock, where each element corresponds to a single item.

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4. Parking lot

A parking lot uses a 1D array to store the status of each parking spot, with a value of 0 indicating an empty spot and value of 1 indicating an occupied spot.

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2D ARRAY

A two-dimensional (2D) array is a rectangular collection of elements, where each element is accessed by a pair of indices. Here are a few examples of how 2D arrays are used in real life:

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1. Chess board

A chess board uses a 2D array to represent the positions of the pieces on the board. Each element in the array corresponds to a single square on the board, with value indicating the type of piece occupying the square or empty.

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2. Map of a city

A map of a city uses a 2D array to represent the layout of the city. Each element in the array corresponds to a single block, with a value indicating the type of terrain r building.

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3. Image Processing System

An image processing software uses a 2D array to represent an image as a grid of pixels. Each element in the rray corresponds to a single pixel in the image, with a value indicating the color of the pixel.

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4. Weather forecasting system

A weather forecasting system uses arrays to store meteorological data from various weather stations such as temperture, pressure, humidity, and wind speed.

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5. Video game

A video game like Tetris, uses a 2D array to represent the game board and the placement of the shapes on it. Each element in the array corresponds to a tile on the board, with a value indicating whether it's occupied or not.

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BIT MANIPULATION

Bit manipulation is a technique of manipulating idividual bits in a binary number to achieve a specific goal. Here are a few examples of how bit manipultion is used in eal life:

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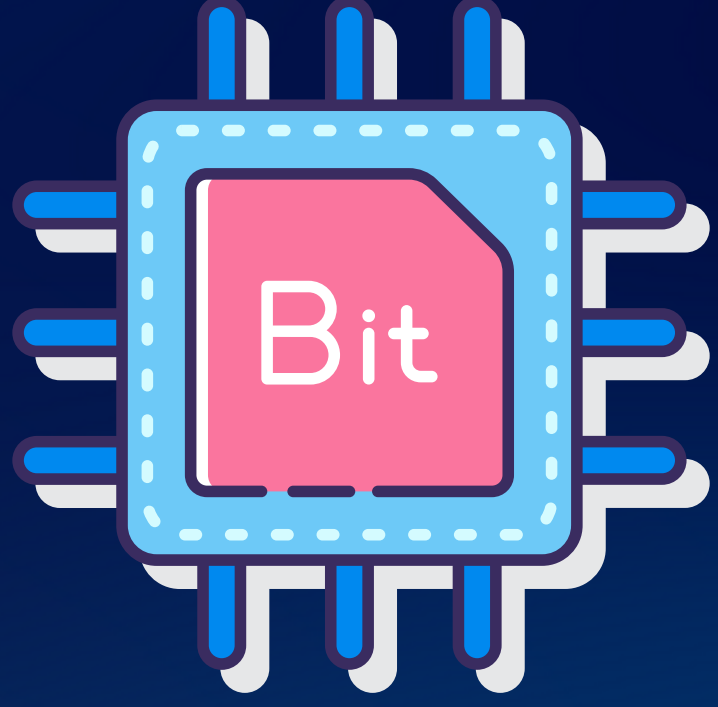

1.Networking protocols

Networking protocols like TCP/IP and Ethernet use bit manipulation to encode and decode packets of data that are sent over the network.

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2. Memory management

Computer memory management uses bit manipulation to keep track of which blocks of memory are in use and which re not.

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3. Cryptography

Cryptography uses bit manipulation to encrypt and decrypt messages to protect them from unauthorized access.

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4. Credit cards & Debit cards

Credit cards, debit cards, and other forms of payment use bit manipulation to encrypt and decrypt sensitive information for secure transactions.

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5. Electronic devices

Electronic devices like smartphones, laptops, and televisions use bit manipulation to display images, videos and to process input from sensors.

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LINKED LIST

A linked list is a data structure that consists of a chain of nodes, where each node contains a value and a reference to the next node in the chain. Here are a few examples of how bit manipulation is used in real life:

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1. Train

Each train car is a node and the couplings between the cars are the links that connect the nodes.

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2. Web browsers' history

A linked list is often used to store the history of visited web pages in a web browser, where each node in the linked list represents a visited page.

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3. To-Do Lists

A linked list can be used to represent a to-do list, where each node in the linked list represents a task and the next pointer points to the next task in the list.

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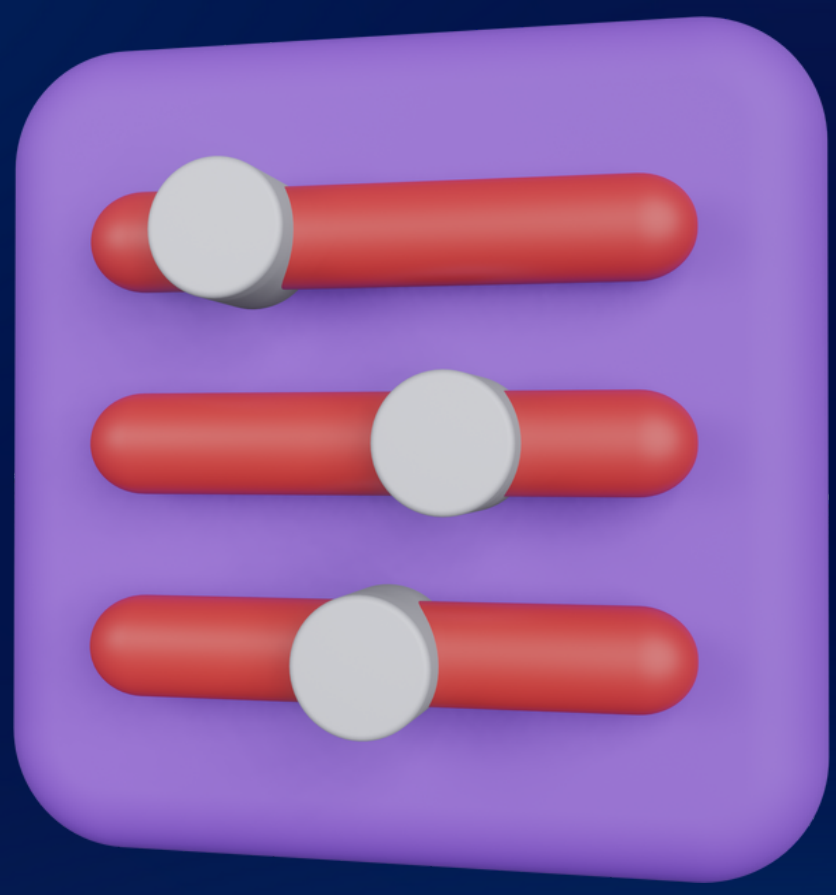
4. Music playlists

A linked list can be used to represent a music playlist, where each node in the linked list represents a song and the next pointer points to the next song in the playlist.



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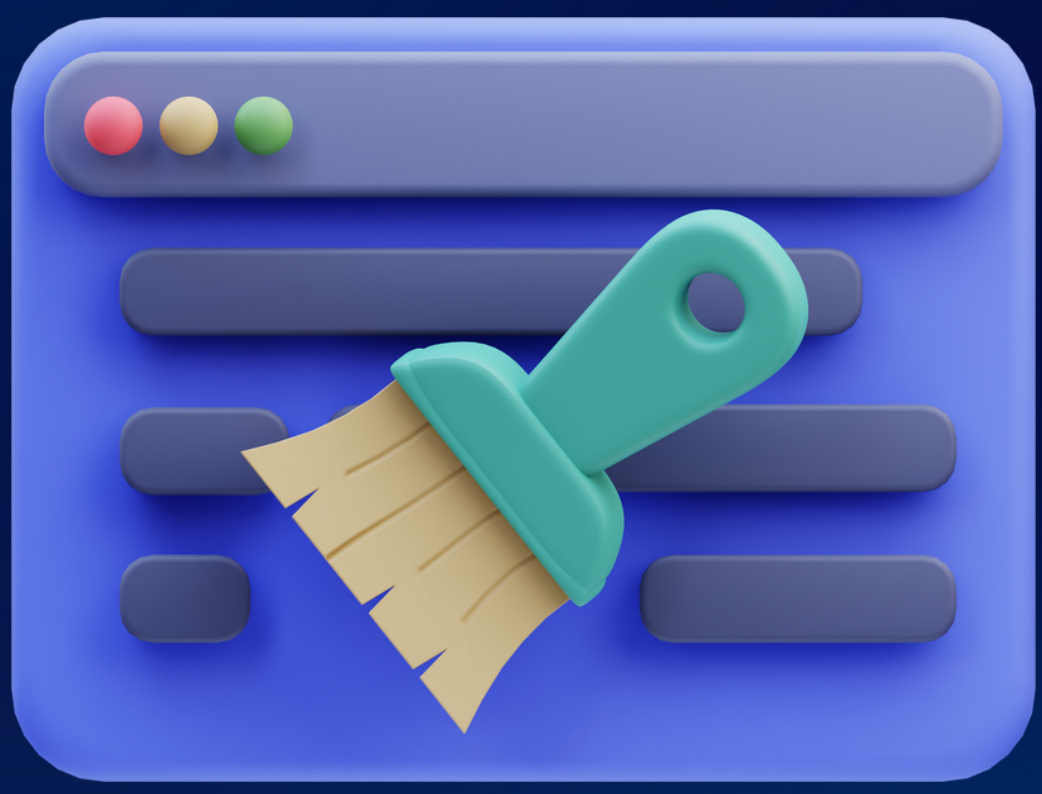
5. LRU Cache

A linked list can be used to implement an LRU (Least Recently Used) Cache, where each node in the linked list represents a key-value pair and the next pointer points to the next most recently used element in the cache.



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BINARY SEARCH

Binary search is an algorithm that is used to quickly find a specific element in a sorted array by repeatedly dividing the search interval in half. Here are a few examples of how binary search is used in real life:

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1. Libraries

Many libraries use binary search to quickly locate specific books, articles, or documents.

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2. Navigation System

Many navigation systems use binary search to quickly locate specific points of interest or locations.

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3. Financial systems

Many financial systems use binary search to quickly locate specific transactions in a large database of financial data.

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4. Search Engine

Search engines like Google use binary search to quickly search through billions of web pages to find the most relevant results for a user's query.

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5. Inventory Management System

In some inventory management systems, binary search is used to quickly locate specific items in a large database of inventory data.

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STACK

A stack is a linear data structure that follows the Last In First Out (LIFO) principle, meaning the last item to be added to the stack is the first one to be removed. Here are some real-life examples of stacks

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1.Plate Stack

A stack of plates in a cafeteria can be seen as an example of a stack, where the last plate added to the stack is the first one to be removed.

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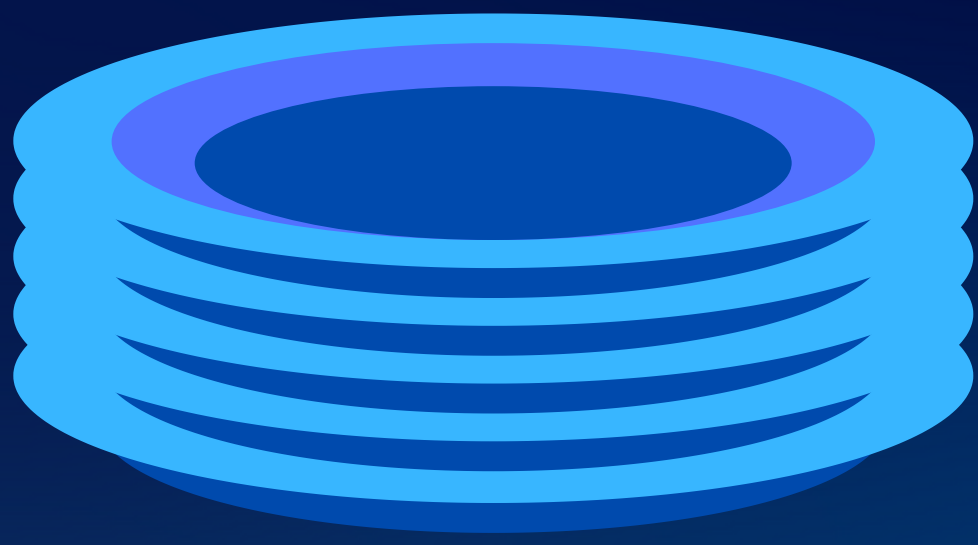

2.Back button in a web browser

The back button in a web browser can be seen as an example of a stack, where each time you visit a new web page, it is pushed onto the

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3.Deck of cards

A deck of cards can be seen as an example of a stack, where the last card added to the stack is the first one to be removed.

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4. Calculator

A simple calculator operates on a stack, where each time a user inputs a number or operator, it is pushed onto the stack, and the result of the calculation is popped from the stack.

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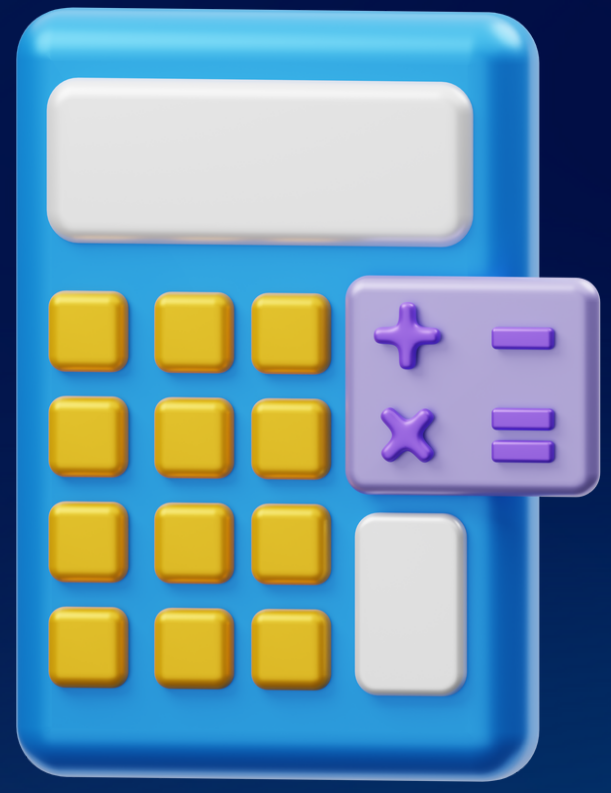

5. Parking lot with multi-level parking

In a multi-level parking lot, cars that enter the lot are stacked in the first available slot, and when a car exits the lot, it is popped from the top of the stack.

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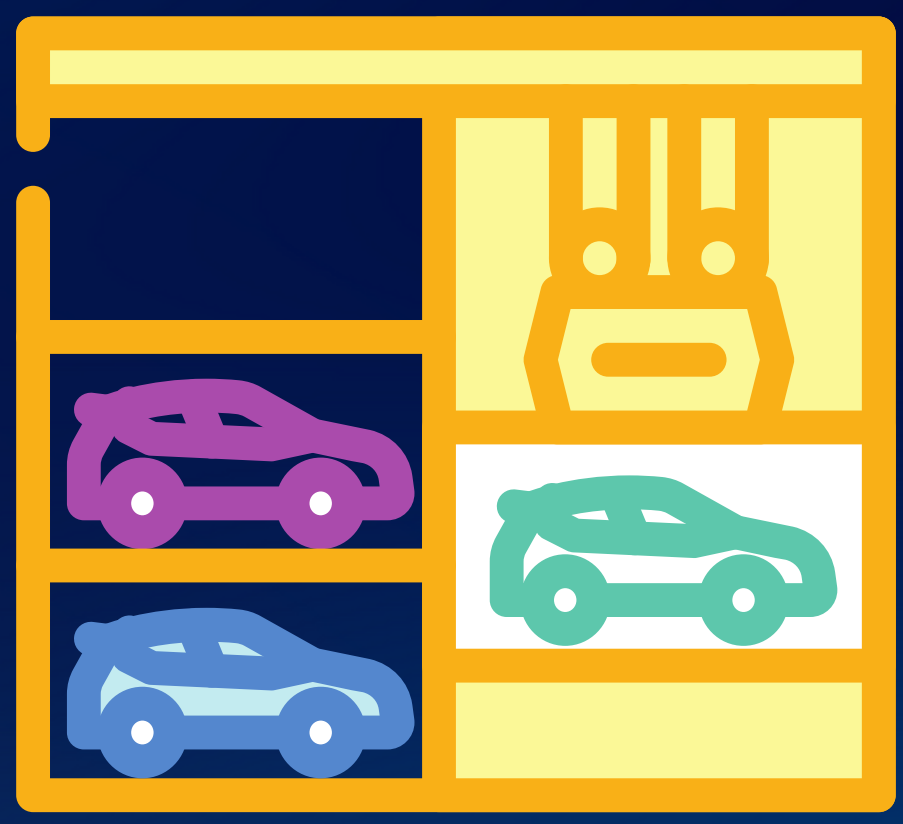

QUEUE

A queue is a linear data structure that follows the First In First Out (FIFO) principle, meaning the first item to be added to the queue is the first one to be removed.

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1.Lines at a checkout counter

A line of people waiting to check out at a grocery store is an example of a queue, where the first person in line is the first one to be helped.

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2. Traffic on a busy road

Cars waiting in a line at a red light can be seen as an example of a queue, where the first car to arrive at the intersection is the first one to proceed when the light turns green.

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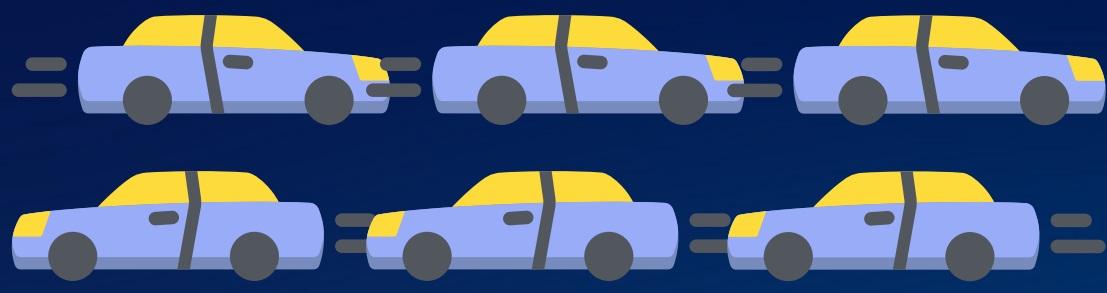

3. Waiting for a ride on Uber or Lyft

When you request a ride on a ride-sharing app like Uber or Lyft, your request is added to a queue of other requests, and the first request in the queue is the first one to be fulfilled.

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4. Requests for service in a call center:

In a call center, calls from customers are added to a queue and handled in the order in which they were received.

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5. Waiting for a table at a restaurant:

When you arrive at a busy restaurant and put your name on the waiting list, your name is added to a queue, and you are seated in the order in which you were added to the queue.

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BACKTRACKING

Backtracking is a general algorithmic technique that involves exploring all possible solutions to a problem by systematically trying out different choices, and undoing the choices that lead to a dead-end.

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1.Planning a trip

When planning a trip, one may consider multiple itineraries and compare the costs, distances, and durations of each itinerary before making a final decision. If an itinerary leads to an undesirable outcome, then one can backtrack and try another itinerary.

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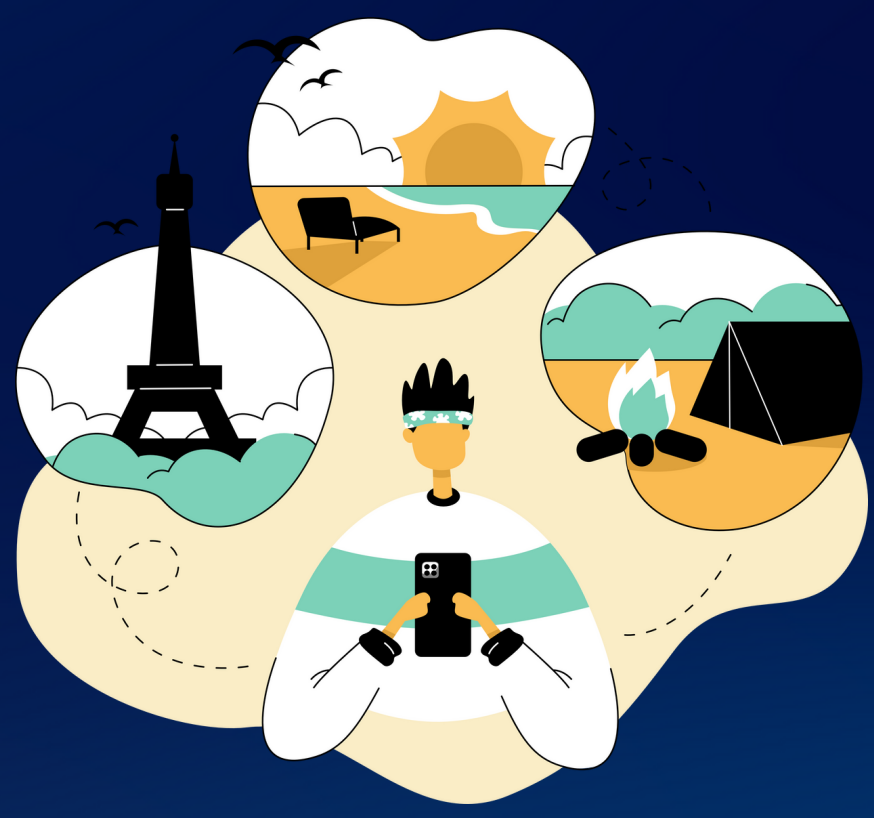

2. Solving a crossword puzzle

When solving a crossword puzzle, one may start with a partially filled grid and then keep trying different words until a solution is found or all possibilities have been exhausted. If a word leads to an invalid solution, then one can backtrack and try another word.

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3. Selecting courses in college

When selecting courses in college, one may consider multiple schedules and compare the prerequisites, conflicts, and availability of each schedule before making a final decision. If a schedule leads to an undesirable outcome, then one can backtrack and try another schedule.

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4. Sudoku puzzle

When solving a Sudoku puzzle, one may start with a partially filled grid and then keep trying different numbers until a solution is found or all possibilities have been exhausted. If a number leads to an invalid solution, then one can backtrack and try another number.

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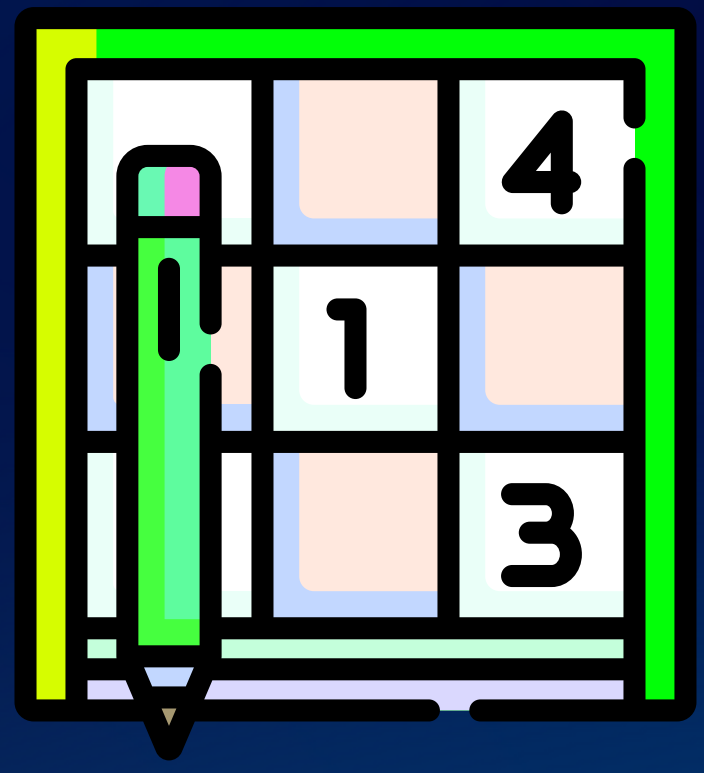

5. Playing chess

When playing chess, a player may consider multiple possible moves and evaluate their consequences before making a final move. If a move leads to a disadvantageous position, then the player can backtrack and try another move.

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TREE

A tree is a hierarchical data structure that is used to model relationships between elements in a structured way. It is composed of nodes, which are connected by edges, and can be thought of as an upside-down tree, with the root node at the top and branches extending downwards to leaf nodes.

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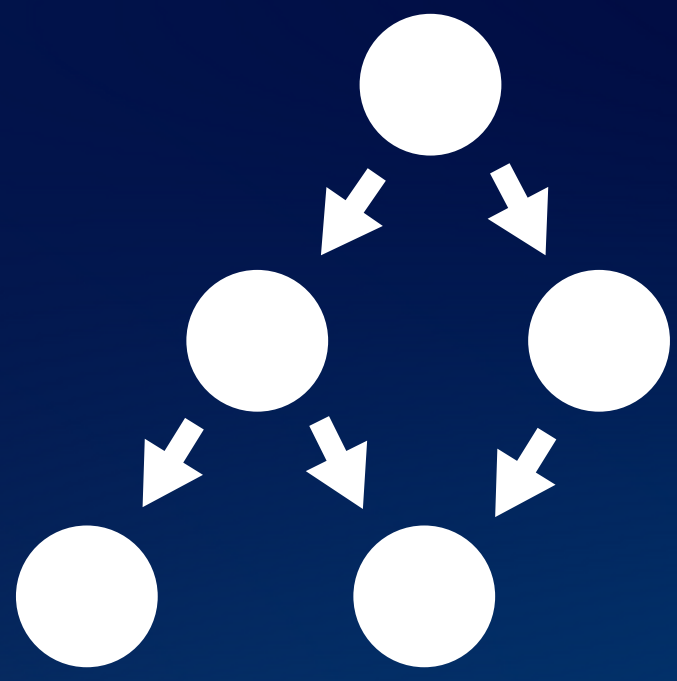

1. File systems

Tree structures are used in file systems to organize and manage files and directories.

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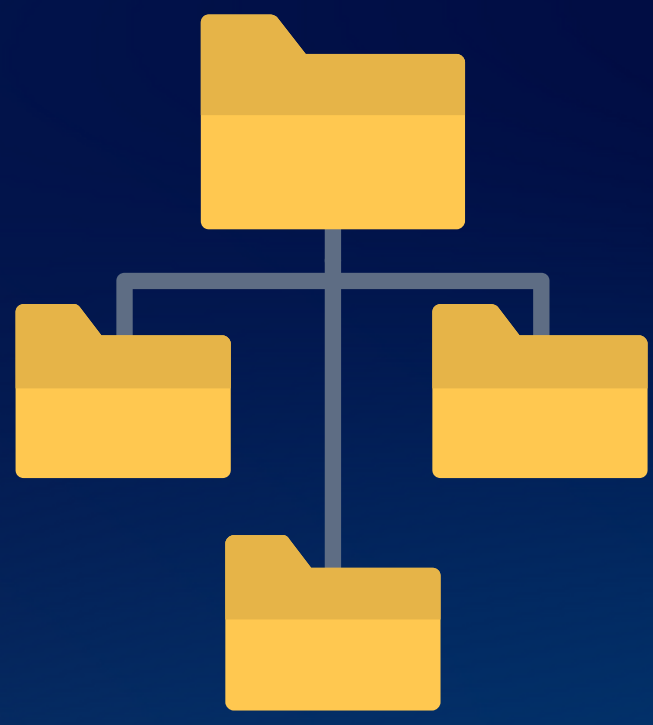

2. Network routing

Trees are used in network routing algorithms to find the shortest path between two nodes in a network.

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3. Genealogy

Family trees are used to represent and visualize the relationships between members of a family.

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4. Decision trees

Trees are used in machine learning to create decision trees, which are used to make predictions or decisions based on certain conditions.

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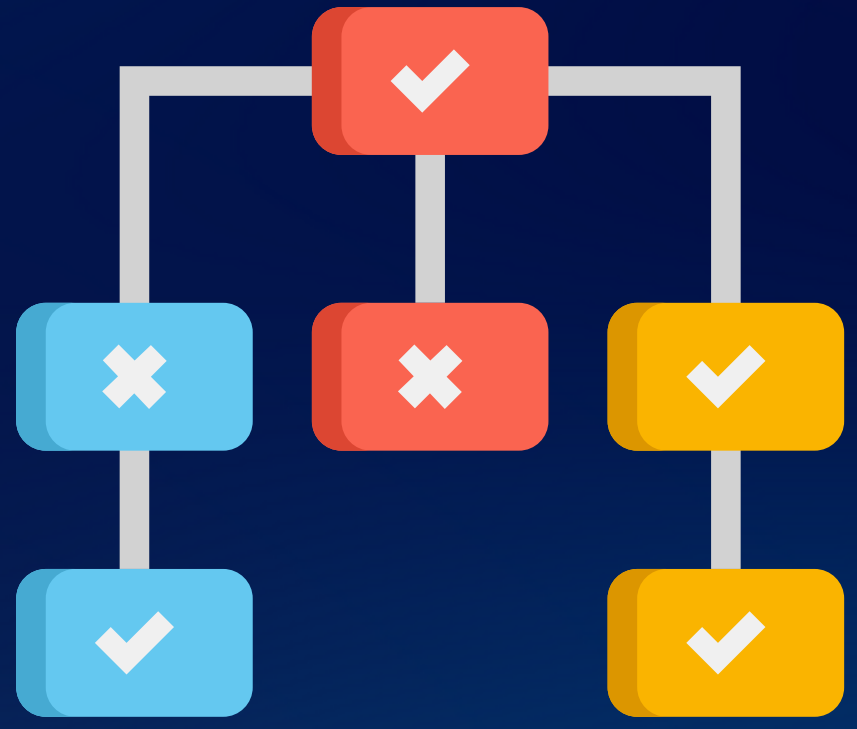
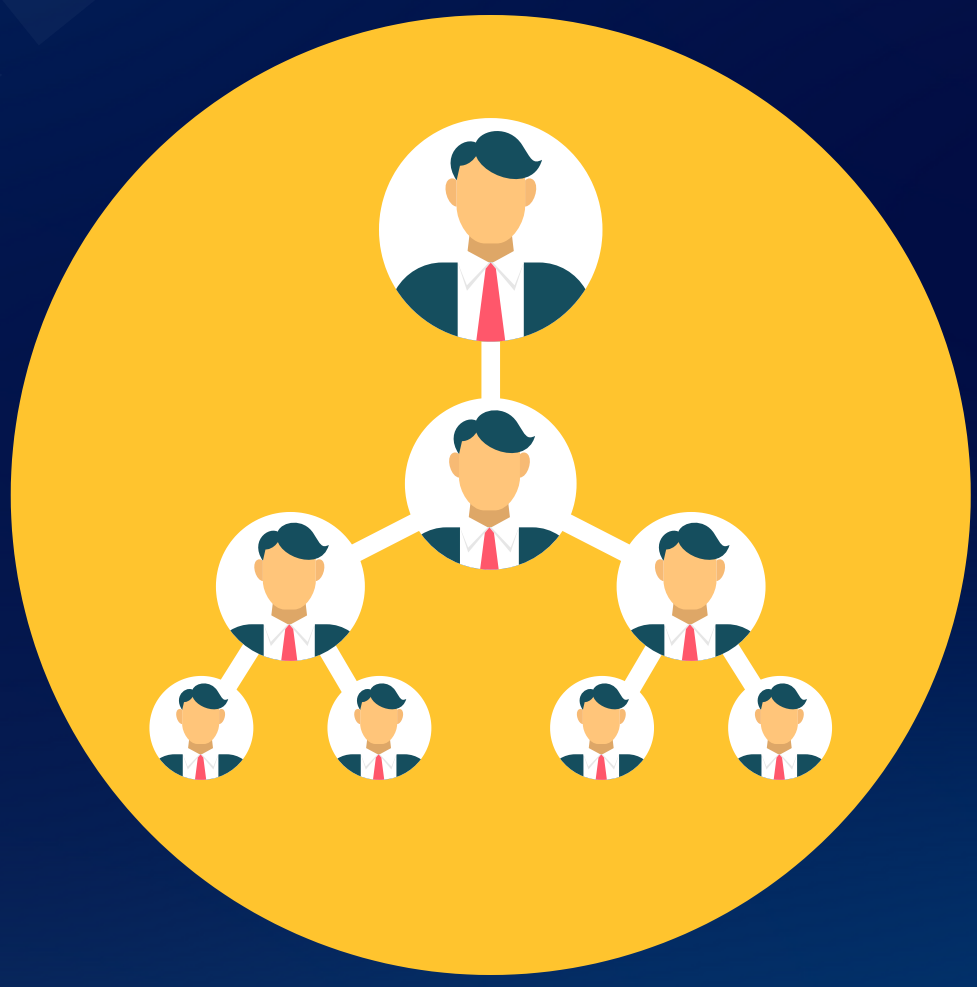


5. Organizational structures

Trees can be used to represent and visualize the relationships between different elements in an organization, such as departments, roles, and employees.



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GRAPH

A graph is a data structure used to model relationships between objects or entities. It consists of vertices, which are the objects or entities being modeled, and edges, which are the connections between the vertices.

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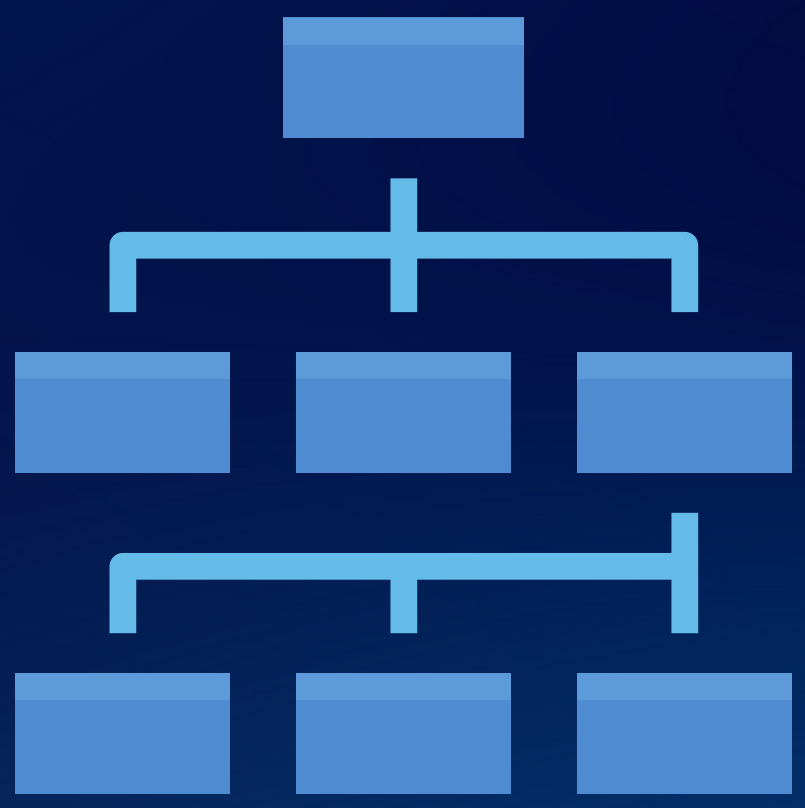

1. Social networks

Graphs are used to represent social networks, including the relationships between people, such as friends, followers, and connections.

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2. Transportation networks

Graphs are used to model transportation networks, including the relationships between cities, roads, and routes.

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3. Maps

Graphs are used to represent maps, including the relationships between geographic locations, such as cities, roads, and landmarks.

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4. Web pages

Graphs are used to represent the relationships between web pages in a hyperlinked document, including links, backlinks, and the structure of the document.

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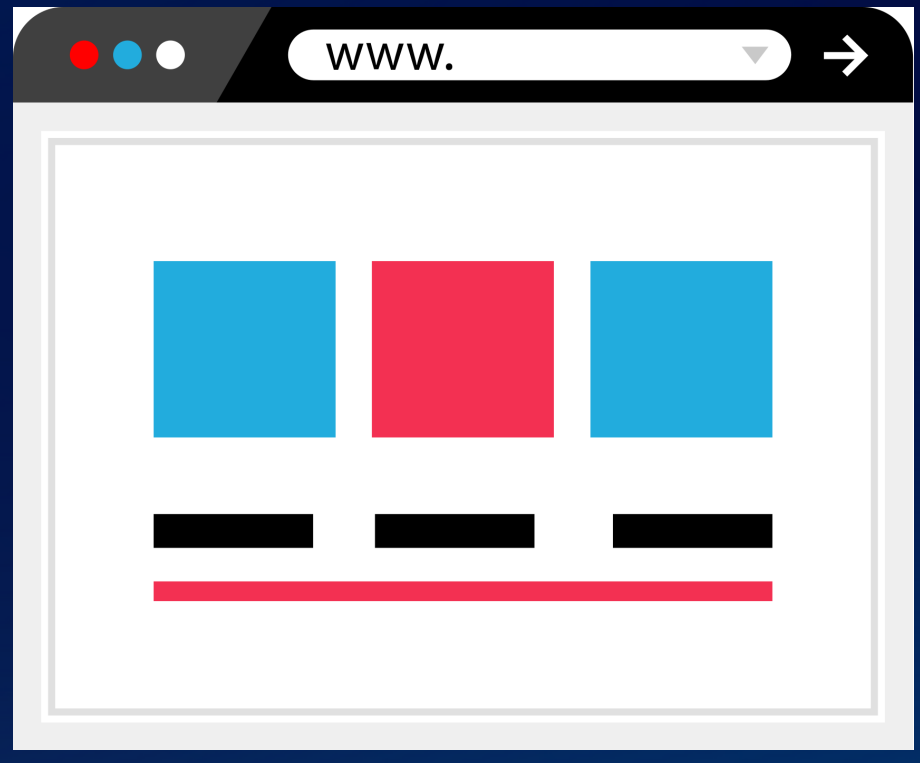

5. Biological systems

Graphs are used to represent biological systems, including the relationships between genes, proteins, and metabolic pathways.

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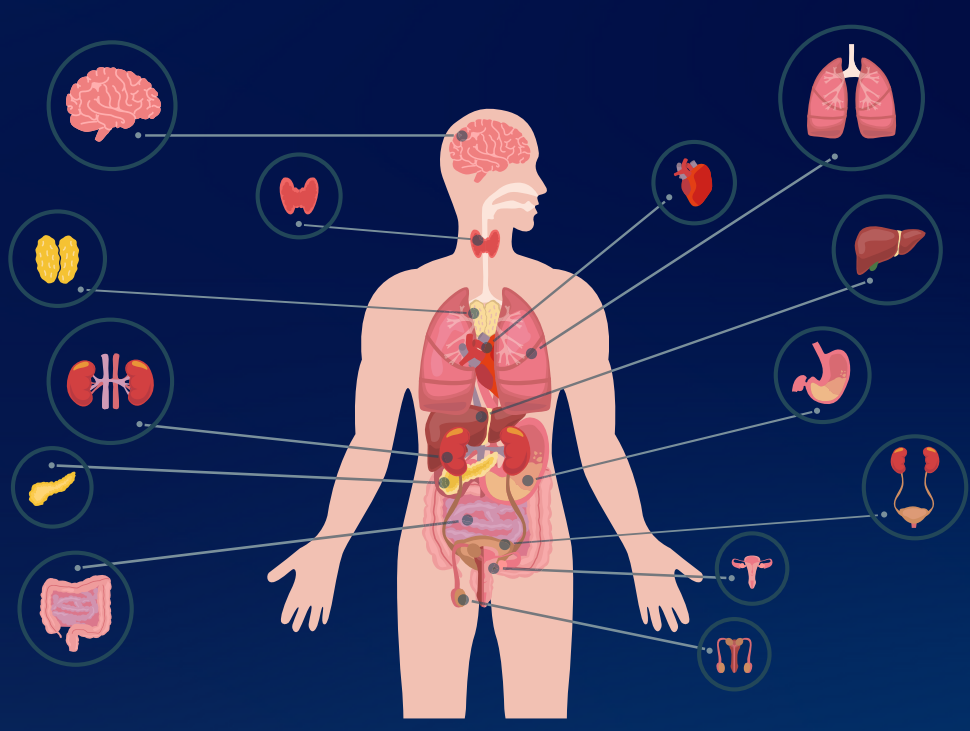

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