Data Structure - Activity - Challenges

1. Linked List: "Human Chain Simulation"

Setup:

- Have each team member represent a node in the linked list.
- Use ribbons or ropes to connect them, symbolizing pointers between nodes.

Activity:

- **Insert Operations:** You (or a “controller”) give instructions like "insert a new node between the second and third node." The person assigned as the new node moves into place, and the "pointers" (ribbons) are adjusted accordingly.
- **Delete Operations:** Similarly, if a node is deleted, that person steps out of the line, and the adjacent members adjust the "pointers."
- **Traversal:** The group walks through the linked list by following the pointers from the head node to the end.

Fun Twist: Use a timer for how fast the team can adjust when nodes are inserted or deleted. Add obstacles or conditions (e.g., reversing the list) to increase difficulty.

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2. Stack: "Cup Tower Challenge"

Setup:

- Give each team member a cup or an item that can be stacked.

Activity:

- **Push:** Each time an item is added to the stack, a team member places their cup/item on top of the stack.
- **Pop:** When an item is removed, the person at the top of the stack removes their cup/item.
- **Peek:** The team points to the topmost cup without removing it.

Fun Twist: Introduce a challenge where the team must stack or unstack in a specific time frame without toppling the stack. You can also simulate real-world stack applications like browser history (push = open a new tab, pop = close the last tab).

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3. Queue: "Waiting Line Simulation"

Setup:

- Line up team members to simulate a queue.

Activity:

- **Enqueue:** A new team member joins the end of the line.
- **Dequeue:** The person at the front of the line steps out.

- **Priority Queue:** Add a twist where some people have "priority" and can jump ahead of others based on certain conditions (e.g., a higher value number written on a badge).

Fun Twist: Simulate real-world queues like ticket counters or a printer job queue. You can also play games like musical chairs where the team must enqueue or dequeue in response to specific events.

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4. Tree: "Human Family Tree or Org Chart"

Setup:

- Assign team members as nodes in a tree. One person starts as the root, and others branch out as children nodes, forming a tree structure with branches.

Activity:

- **Insertion:** Add new members to the tree at different levels based on the structure.
- **Traversal:** Conduct different tree traversals:
    - **Pre-order:** Root, left, right. The team announces their order aloud.
    - **In-order:** Left, root, right.
    - **Post-order:** Left, right, root.
- **Binary Search Tree:** Arrange people based on their "values" (you can use number badges or alphabetic letters) and let the team simulate binary search operations.

Fun Twist: Use a real-world analogy like an organizational hierarchy or a family tree. Give the "nodes" tasks based on traversal orders, such as passing a message or item in the correct sequence.

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5. Hash Map: "Key-Value Pair Matching Game"

Setup:

- Create index cards or slips, half with keys and half with values. Distribute them randomly among team members.

Activity:

- Each person must find their matching key or value by working with the team to hash their key to the correct value (either by calling out the key or physically moving to match pairs).

Fun Twist: Make it a race to see how fast they can form all correct key-value pairs. You can also simulate hash collisions where multiple team members have to compete for the same value and figure out how to resolve it (like chaining or open addressing).

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6. Graph: "City Map Navigation"

Setup:

- Draw a basic graph on the floor with tape, representing cities (nodes) and roads (edges).

Activity:

- **Breadth-First Search (BFS):** The team simulates BFS by visiting nodes level by level (one city at a time), using ropes or strings to mark visited cities.
- **Depth-First Search (DFS):** The team tries to explore one path to the deepest city before backtracking to explore other routes.

Fun Twist: Set up a scenario where they have to navigate from one city to another using BFS or DFS. Add obstacles or rules, such as limited fuel, that forces them to find the shortest path.