Vivekanand Education Society's Institute Of Technology

Department Of Information Technology

DSA mini Project

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Title:

Sustainability Goal :

Domain: Data Structure and Algorithms

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1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
THE GLOBAL GOALS
For Sustainable Development
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE AND JUSTICE STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS

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Introduction to Project

- The Tower of Hanoi Visualizer demonstrates the classic recursive puzzle of moving discs between pegs.
- Users can visualize each move step-by-step for better understanding.
- The project showcases recursion and algorithmic problem-solving in an interactive way.
- It combines dynamic frontend visuals with automated computation of optimal moves.

Problem Statement

Rules of Tower of Hanoi

1. Only one disc can be moved at a time.
2. Each move consists of taking the top disc from one peg and placing it on another peg.
3. A disc can only be placed on an empty peg or on a larger disc.
4. The goal is to move all discs from the source peg to the destination peg following these rules.

Objectives of the project

- The puzzle demonstrates optimal moves using recursion: the minimum number of moves required is 2^n - 1 for n discs.
- To automatically compute and display the optimal sequence of moves.
- To provide a user-friendly interface for learning and experimentation.

Requirements of the system (Hardware, software)

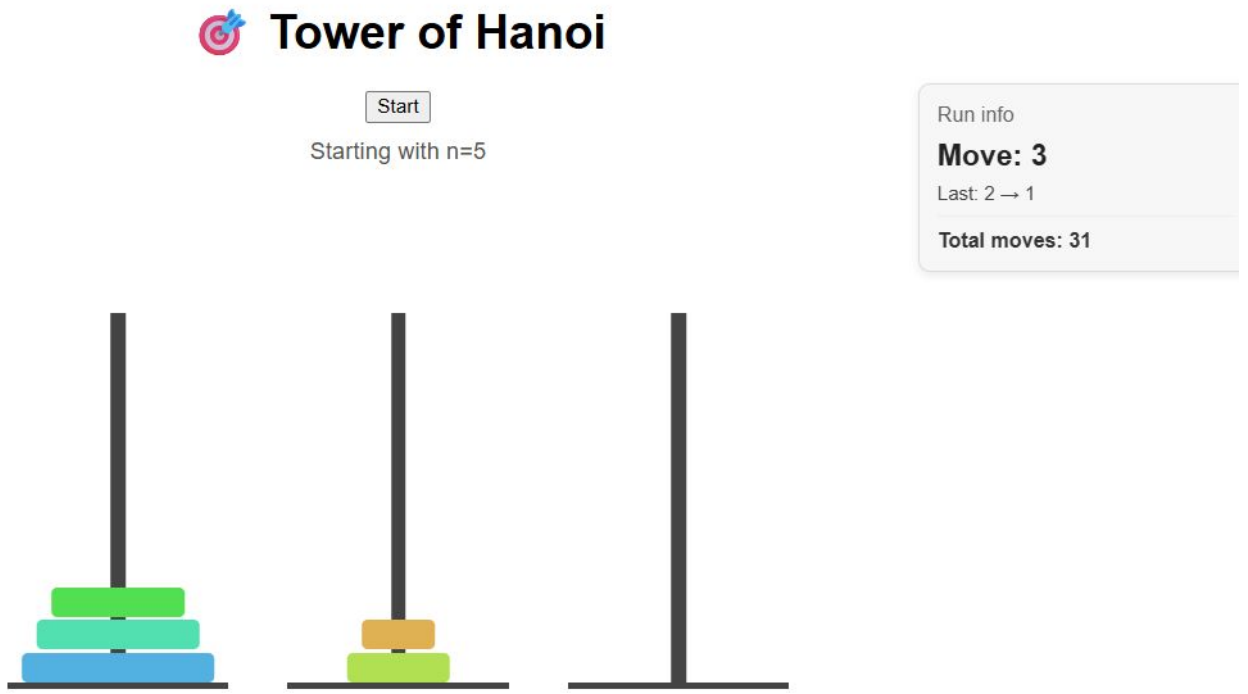
Hardware Requirements:

- Minimum 4 GB RAM
- 1 GHz processor or higher

Software Requirements:

- Web Browser (Chrome, Firefox, Edge) for WASM support
- Python (for http.server)
- Text editor/IDE for editing HTML, CSS, and JS (e.g., VS Code)
- MinGW-w64 (gcc >= 8)
- Emscripten: use the latest supported emsdk to convert in Webassembly code

Front End


Tower of Hanoi
Start
Starting with n=5
Run info
Move: 3
Last: 2 → 1
Total moves: 31

Implementation

- **Data Structure** used three **stacks**, representing the three pegs, to store the disks.
- The project is implemented using **C language** for computing the optimal sequence of moves
- A frontend interface (HTML, CSS, JavaScript) is used to visually display the movement of discs between pegs.
- Recursive algorithm is applied to solve the puzzle:
- Moves are generated automatically and displayed step-by-step in the visualizer for easy understanding.
- User interaction allows the selection of number of discs, and the visualizer dynamically adjusts the display accordingly.

Gantt Chart

- Week 1 :Recursive logic decoding
- Week 1 : C code with terminal output
- Week 2 : HTML , CSS frontend
- Week 2 : Integration of frontend with C wasm code

Conclusion

The Tower of Hanoi project successfully demonstrates the principles of recursion and algorithmic problem-solving in a visual and interactive way. By implementing both the backend logic and a frontend visualization, the project helps in understanding how complex problems can be broken down into simpler subproblems.

- How recursion works step by step.
- How to represent algorithmic logic visually for better comprehension.
- Integration of frontend and backend to create a complete interactive application.

References

https://en.wikipedia.org/wiki/Tower_of_Hanoi

https://www.mathsisfun.com/games/towerofhanoi.html