

Tower of Hanoi Game Report

Project Title: Tower of Hanoi Game

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Course: Object-Oriented Programming and Computer Graphics (OOPCG)

Abstract

Introduction: The Tower of Hanoi is a classic mathematical puzzle involving three rods and a number of disks of different sizes, which can slide onto any rod. The puzzle starts with the disks neatly stacked in ascending order of size on one rod, the smallest at the top, making a conical shape. This project simulates the Tower of Hanoi problem using C++ to enhance understanding of recursion and algorithmic problem-solving.

Motivation: Solving the Tower of Hanoi puzzle is an excellent way to practice and understand recursive functions, which are a fundamental concept in computer science. The project aims to provide a clear, visual, and interactive way of understanding the recursive solution to this problem through a C++ program.

Outcome: This project demonstrates the application of recursive programming in solving the Tower of Hanoi problem. By using C++ constructs such as functions, loops, and conditionals, we created an interactive console-based game that allows users to experience and solve the Tower of Hanoi puzzle. The outcome is a user-friendly application that visually demonstrates the steps to solve the puzzle.

Objectives

1. To develop a C++ program that simulates the Tower of Hanoi puzzle.
2. To provide a clear demonstration of recursive problem-solving techniques.
3. To create an interactive console-based game that allows users to solve the Tower of Hanoi puzzle.

4. To showcase the use of functions and recursion in C++.
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Hardware and Software Requirements

Hardware Requirements:

- **Processor:** Intel Core i3 or equivalent (minimum)
- **RAM:** 4GB (minimum)
- **Storage:** 100 MB of free disk space
- **Display:** Standard monitor with at least 800x600 resolution

Software Requirements:

- **Operating System:** Windows, macOS, or Linux
 - **Compiler:** Any C++ compiler (e.g., GCC, Clang, or Microsoft Visual C++)
 - **Development Environment:** Recommended to use Visual Studio Code, Code::Blocks, or any other IDE with C++ support
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System Overview

Features and Functionalities:

- **Interactive Console Interface:** Users can interact with the program via the console to see each step of the puzzle solution.
 - **Visualization of Moves:** Each move is displayed on the console, showing the transfer of disks between rods.
 - **Customizable Disk Number:** Users can input the number of disks for the puzzle.
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Theoretical Concepts

Recursive Problem-Solving

The Tower of Hanoi game is a perfect demonstration of recursion, a core concept in computer science. The recursive function moves the disks following the rules of the game:

1. **Move n-1 disks from source to auxiliary rod.**
 2. **Move the nth disk from source to destination rod.**
 3. **Move the n-1 disks from auxiliary rod to destination rod.**
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Program Structure

Functions and Modules:

- `towerOfHanoi(n, source, destination, auxiliary)`: The main recursive function to solve the puzzle.
- `moveDisk(from_rod, to_rod)`: A helper function to display the movement of disks.

Control Structures:

- **Recursive Calls**: The function calls itself to move smaller subsets of disks, breaking down the problem into simpler sub-problems.
 - **Base Condition**: The recursion terminates when there is only one disk to move.
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Output:

Below are some screenshots showcasing the functionality and output of our Library Management System.

```
HELLO!
```

```
THIS IS A SHORT GAME NAMED 'THE TOWER OF HANOI'
```

```
ABOUT THE GAME:
```

```
MOVE ALL THE DISKS FROM THE LEFTMOST ROD TO THE RIGHTMOST ROD.
```

```
ONLY ONE DISK MAY BE MOVED AT A TIME AND
```

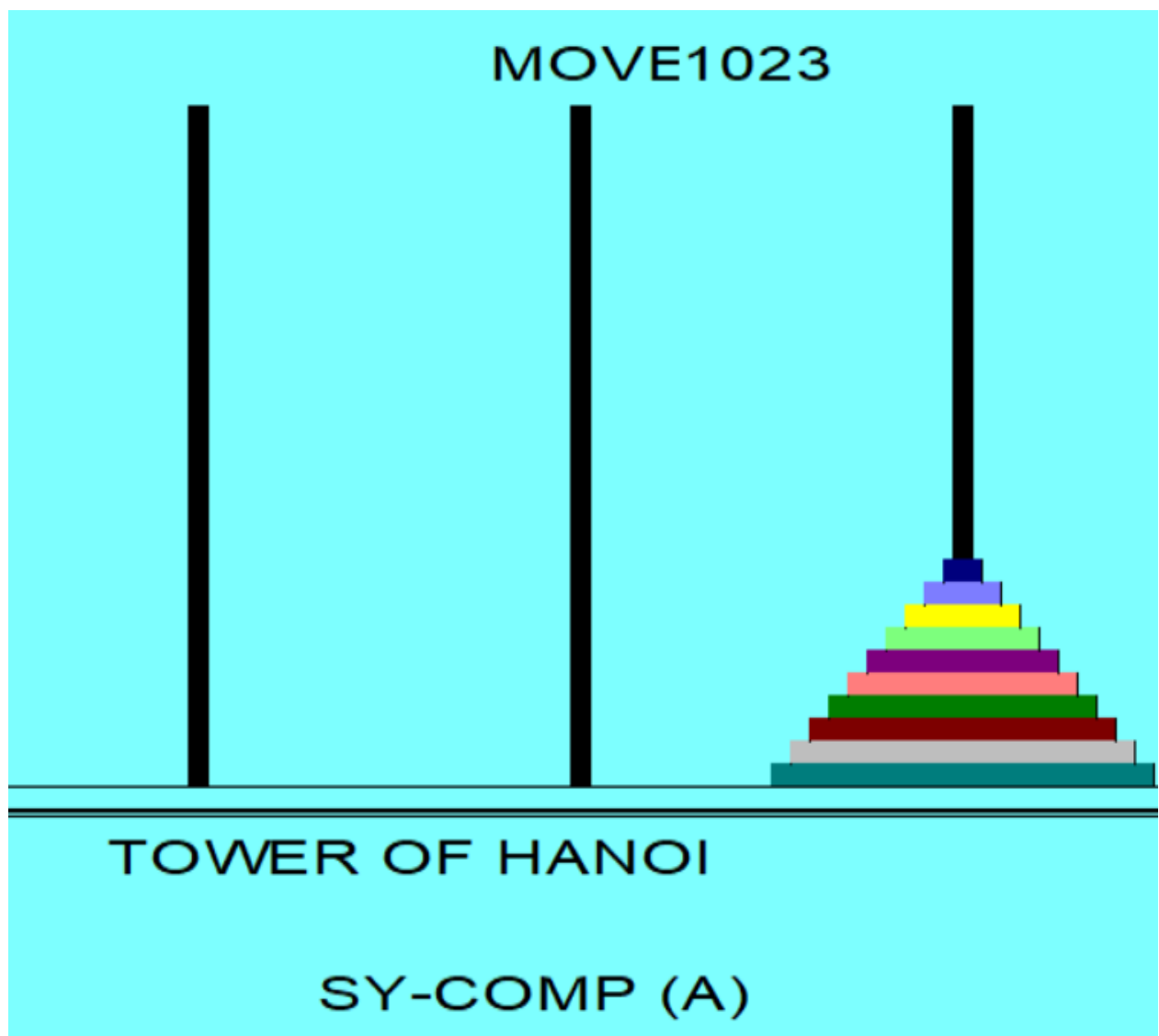
```
IT IS NOT POSSIBLE TO PLACE A BIGGER DISK ON TOP OF A
```

```
SMALLER DISK.
```

```
THE ORIGINAL LA TOUR D'HANOI PUZZLE WAS INVENTED BY
```

```
FRANCOIS EDOUARD ANATOLE LUCAS IN 1883. ENTER THE NUMBER OF DISCS YOU WANT TO SEE THE SOLUTION (1-10):
```

```
10
```



Conclusion

The Tower of Hanoi Game project effectively demonstrates the use of recursive functions to solve a classic mathematical puzzle. This project has enhanced our understanding of recursion, algorithmic problem-solving, and the practical application of C++ programming concepts. The outcome is an interactive console-based game that not only provides a solution to the Tower of Hanoi problem but also serves as an educational tool for understanding recursion.

The project lays a strong foundation for further exploration of advanced algorithms and reinforces both theoretical knowledge and practical skills in programming.
