Title: A Representation Approach to the Tower of Hanoi Problem

Author: M.C. Er

Introduction:
- The Tower of Hanoi is a classic puzzle used to demonstrate recursion. However, the recursive solutions can be hard for beginners to understand.

- This paper presents an iterative algorithm to solve the Tower of Hanoi by using a bit-string representation to explicitly encode the directions of disc moves.

- The goals are to develop a straightforward algorithm and analyze the behavior of disc moves based on the representation.

Problem:
- There are 3 pegs (P1, P2, P3) and n discs (D1, D2, ..., Dn) of increasing size.

- The goal is to move all discs from one peg to another, following constraints: only top disc can be moved, never place larger disc over smaller disc, only move one disc at a time.

Representation:
- Directions are encoded as left/right branches of a binary tree, then collapsed into a bit-string using 0=clockwise, 1=anticlockwise.

- Bit-strings are generated recursively. BS(n) is created by prepending and appending inverted BS(n-1) to BS(n-1).

Properties:
- Bit-strings have symmetry about the center bit.

- D1 (smallest disc) moves are always first, last, and at odd positions.

- D1 alternates moves with other discs.

- D1 always moves cyclically.

- The bit-string solution is proven optimal, taking 2^n - 1 steps.

- Discs with odd/even indices move in opposite directions.

Algorithm:
- Iterate 2^n - 1 times. Move D1 based on bit parity. Move other discs based on D1's peg.

- An iterative C program implements this algorithm.

- The bit-string can also be generated directly using the established properties.

Conclusion:
- Representing directions explicitly leads to an elegant Tower of Hanoi solution.

- The bit-string representation enables analyzing properties of optimal disc moves.