4. APPLICATION OF STACK – TOWER OF HANOI

Preamble

The following are some crucial applications of stack data structure.

Function calls: Stacks are used to keep track of the return addresses of function calls, allowing the program to return to the correct location after a function has finished executing.

Recursion: Stacks are used to store the local variables and return addresses of recursive function calls, allowing the program to keep track of the current state of the recursion.

Expression evaluation: Stacks are used to evaluate expressions in postfix notation (Reverse Polish Notation).

Syntax parsing: Stacks are used to check the validity of syntax in programming languages and other formal languages.

Memory management: Stacks are used to allocate and manage memory in some operating systems and programming languages.

Steps

- Define the function `towerOfHanoi` with the required parameters.
- Move the rods by defining it as A, B and C and using stack method, move the rods.

Implementation in C

```
// C recursive function to solve tower of hanoi puzzle
void towerOfHanoi(int n, char from_rod, char to_rod, char aux_rod)
{
      if (n == 1)
      {
            printf("\n Move disk 1 from rod %c to rod %c", from_rod, to_rod);
            return;
      }
      towerOfHanoi(n-1, from_rod, aux_rod, to_rod);
```

```
      printf("\n Move disk %d from rod %c to rod %c", n, from_rod, to_rod);
      towerOfHanoi(n-1, aux_rod, to_rod, from_rod);
}

int main()
{
      int n = 4; // Number of disks
      towerOfHanoi(n, 'A', 'C', 'B');  // A, B and C are names of rods
      return 0;
}
```

Sample Input and Output

```
Move disk 1 from rod A to rod B
Move disk 2 from rod A to rod C
Move disk 1 from rod B to rod C
Move disk 3 from rod A to rod B
Move disk 1 from rod C to rod A
Move disk 2 from rod C to rod B
Move disk 1 from rod A to rod B
Move disk 4 from rod A to rod C
Move disk 1 from rod B to rod C
Move disk 2 from rod B to rod A
Move disk 1 from rod C to rod A
Move disk 3 from rod B to rod C
Move disk 1 from rod A to rod B
Move disk 2 from rod A to rod C
Move disk 1 from rod B to rod C
```