Assignment On

‘ADVANCED DATA STRUCTURES AND ALGORITHMS’ (Assignment-4)

Submitted by:
K. Shiva Kiran
2503B05121(M.TECH).

Submitted to:
Dr. Rahul Mishra.

Question:
Solve the Towers of Hanoi Problem Recursively. Also, Implement a Stack-Based Iterative Solution.

Code :

```
# ------------------------------------------------

# 1. RECURSIVE TOWERS OF HANOI

# ------------------------------------------------ def

recursive_hanoi(n, source, auxiliary, destination):

if n == 1:

        print(f"Move disk 1 from {source} →

{destination}")        return


    recursive_hanoi(n - 1, source, destination, auxiliary)

print(f"Move disk {n} from {source} → {destination}")

recursive_hanoi(n - 1, auxiliary, source, destination)


# ------------------------------------------------

# 2. ITERATIVE TOWERS OF HANOI USING STACKS

# ------------------------------------------------

def move_disk(from_rod, to_rod, from_name, to_name):
  disk = from_rod.pop()
to_rod.append(disk)     print(f"Move disk
{disk} from {from_name} → {to_name}")


def legal_move(rod1, rod2, name1, name2):     if not
rod1:  # rod1 empty → move from rod2 to rod1
move_disk(rod2, rod1, name2, name1)     elif not
rod2:  # rod2 empty → move from rod1 to rod2
move_disk(rod1, rod2, name1, name2)     elif rod1[-
1] < rod2[-1]:  # smaller disk moves
move_disk(rod1, rod2, name1, name2)     else:
      move_disk(rod2, rod1, name2, name1)

def iterative_hanoi(n):
   # Stacks (rods)
A = list(range(n, 0, -1))  # Start rod (largest → smallest)
B = []
C = []

   total_moves = (2 ** n) - 1

   print("\nIterative Solution:")

   # Swap auxiliary and destination for even number of
disks     if n % 2 == 0:
      aux_name, dest_name = "C", "B"
else:
      aux_name, dest_name = "B", "C"
```

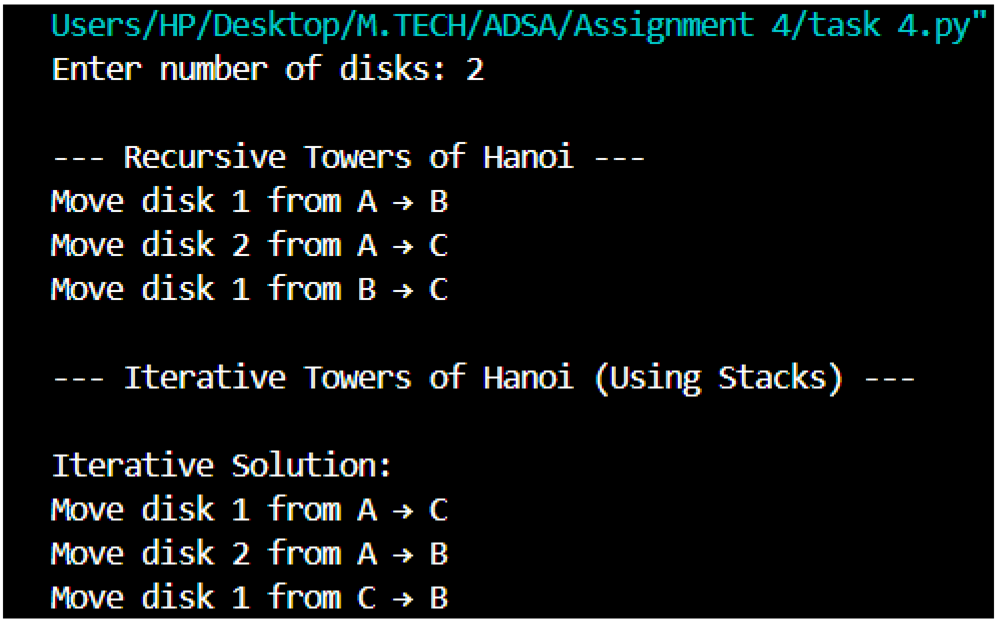
```
    for move in range(1, total_moves +
1):        if move % 3 == 1:
           legal_move(A, C, "A", "C")
        elif move % 3 == 2:
            legal_move(A, B, "A",
"B")        else:
            legal_move(B, C, "B", "C")

# -------------------------------------------------
# MAIN PROGRAM (RUN BOTH SOLUTIONS)
# -----------------------------------------------
-- if __name__ == "__main__":
    n = int(input("Enter number of disks: "))

    print("\n--- Recursive Towers of Hanoi ---")
recursive_hanoi(n, "A", "B", "C")

    print("\n--- Iterative Towers of Hanoi (Using Stacks)
---")     iterative_hanoi(n)
```

Output:



```
Users/HP/Desktop/M.TECH/ADSA/Assignment 4/task 4.py"
Enter number of disks: 2

--- Recursive Towers of Hanoi ---
Move disk 1 from A → B
Move disk 2 from A → C
Move disk 1 from B → C

--- Iterative Towers of Hanoi (Using Stacks) ---

Iterative Solution:
Move disk 1 from A → C
Move disk 2 from A → B
Move disk 1 from C → B
```