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Tower of Hanoi

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What is Tower of Hanoi?

- It consists of three rods(pegs) and a number of disks of different sizes, which can slide onto any rod.
- The puzzle starts with the disks in a neat stack in ascending order of size on one rod, the smallest at the top, thus making a conical shape
- https://www.youtube.com/watch?v=5_6nsViVM00

Rules to move rod:

- Only one disk can be moved at a time.
- Each move consists of taking the upper disk from one of the stacks and placing it on top of another stack.
- No disk may be placed on top of a smaller disk.

With 3 disks, the puzzle can be solved in 7 moves.

The minimal number of moves required to solve a Tower of Hanoi puzzle is $2^n - 1$, where n is the number of disks.

Steps:

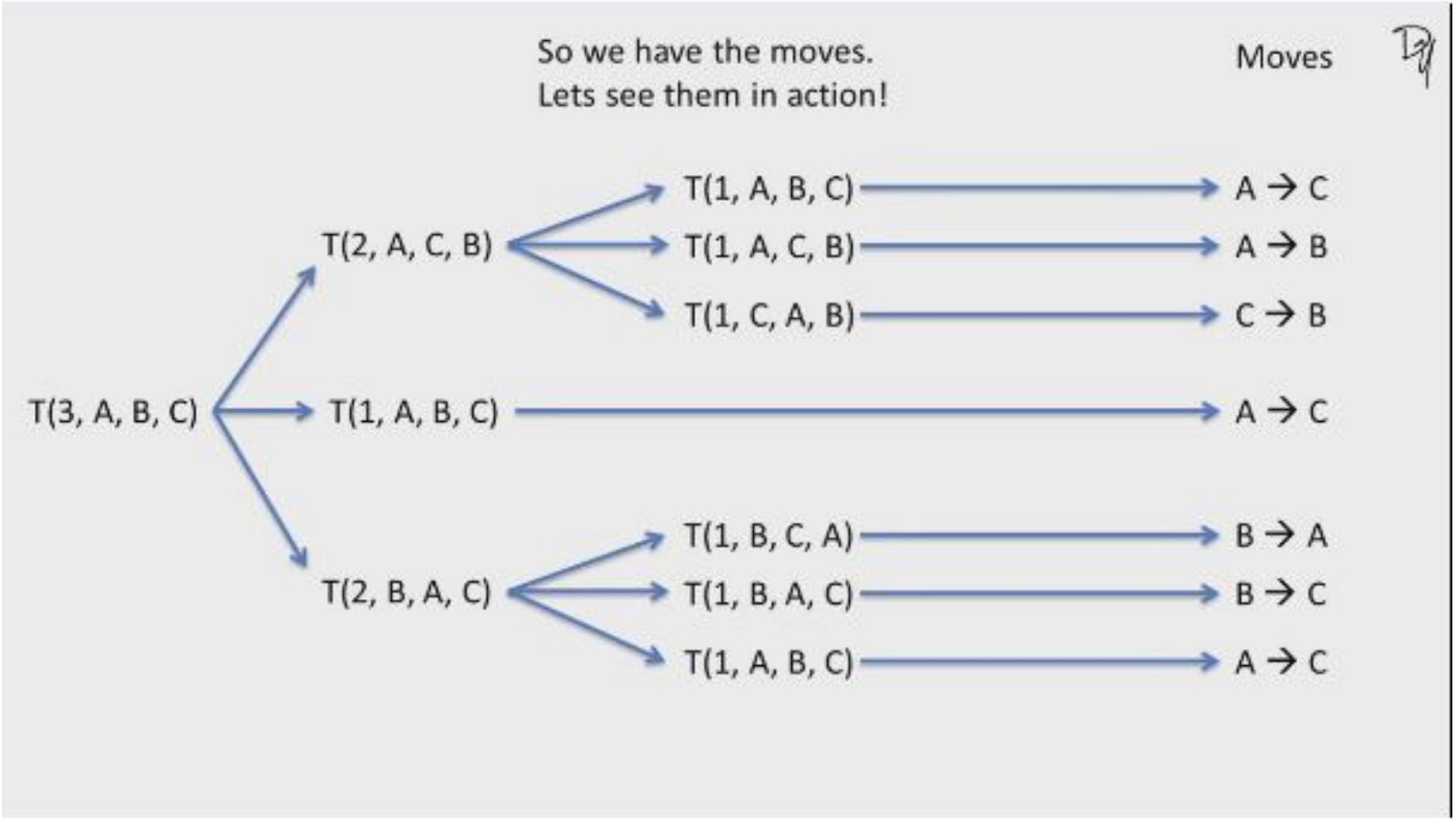
T(N, Beg, Aux, End)

***T** denotes our procedure*
***N** denotes the number of disks*
***Beg** is the initial peg*
***Aux** is the auxiliary peg*
***End** is the final peg*

1. *T(N-1, Beg, End, Aux)*
2. *T(1, Beg, Aux, End)*
3. *T(N-1, Aux, Beg, End)*

*Step 1 says: Move top (N-1) disks from **Beg to Aux** peg.*
*Step 2 says: Move 1 disk from **Beg to End** peg.*
*Step 3 says: Move top (N-1) disks from **Aux to End** peg.*

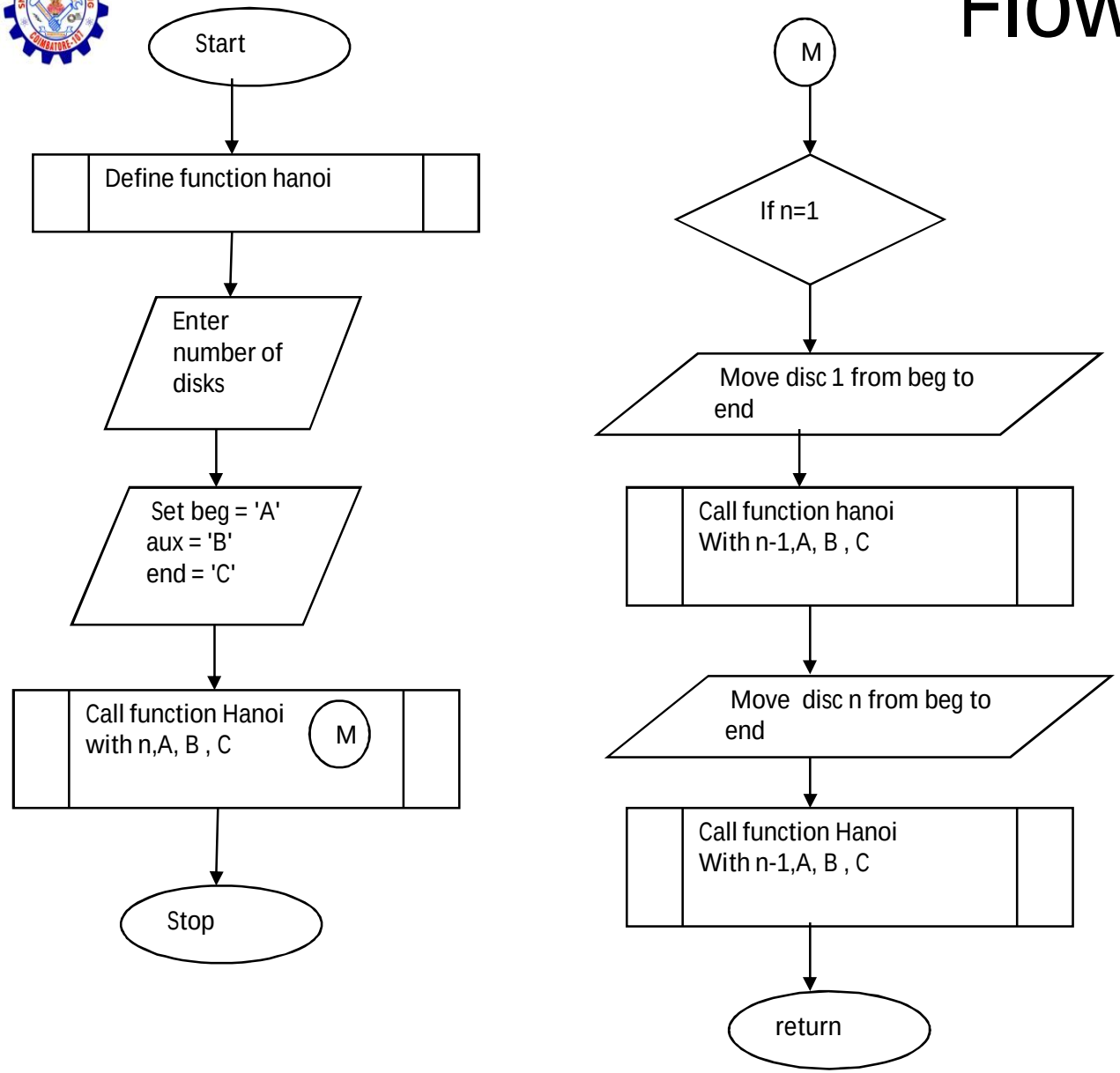
N=3


So we have the moves.
Lets see them in action!
Moves
T(3, A, B, C)
T(2, A, C, B)
T(1, A, B, C)
T(1, A, C, B)
T(1, C, A, B)
T(1, A, B, C)
T(2, B, A, C)
T(1, B, C, A)
T(1, B, A, C)
T(1, A, B, C)
A → C
A → B
C → B
A → C
B → A
B → C
A → C

Pseudocode

```
/*N = Number of disks          Beg, Aux, End are the pegs
*/
T(N, Beg, Aux, End)
Begin
   if N = 1 then
      Print: Beg → End;
   else
      Call T(N-1, Beg, End, Aux);
      Call T(1, Beg, Aux, End);
      Call T(N-1, Aux, Beg, End);
   endif
End
```

Flowchart


Start
Define function hanoi
Enter number of disks
Set beg = 'A'
aux = 'B'
end = 'C'
Call function Hanoi with n,A, B , C
M
Stop
M
If n=1
Move disc 1 from beg to end
Call function hanoi With n-1,A, B , C
Move disc n from beg to end
Call function Hanoi With n-1,A, B , C
return

Program

```
disks = 3
beg = 'A'
aux = 'B'
end = 'C'
def hanoi(n, beg, aux, end):
    if n > 0:
        hanoi(n-1, beg, end, aux)
        print( 'move disk from ', beg, ' to ', end)
        hanoi(n-1, aux, beg, end)
hanoi(disks, beg, aux, end)
```

Output

move disk from A to C

move disk from A to B

move disk from C to B

move disk from A to C

move disk from B to A

move disk from B to C

move disk from A to C

Thank you