

Algorithms & Data Structure : Day 2

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Linear Search

- Find 37?

0	1	2	3	4	5	6	7	8
20	35	37	40	45	50	51	55	67



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Return 2

Linear Search

Algorithm

Consider **LA** is a linear array with **N** elements and **K** is a positive integer such that $K \leq N$. Following is the algorithm to find an element with a value of **ITEM** using sequential search.

1. Start
2. Set $J = 0$
3. Repeat steps 4 and 5 while $J < N$
4. IF $LA[J]$ is equal **ITEM** THEN GOTO STEP 6
5. Set $J = J + 1$
6. PRINT J , **ITEM**
7. Stop

Binary Search

- Find 37?
 - Sort Array.

0	1	2	3	4	5	6	7	8
20	35	37	40	45	50	51	55	67

Binary Search

```
Procedure binary_search
  A ← sorted array
  n ← size of array
  x ← value to be searched

  Set lowerBound = 1
  Set upperBound = n

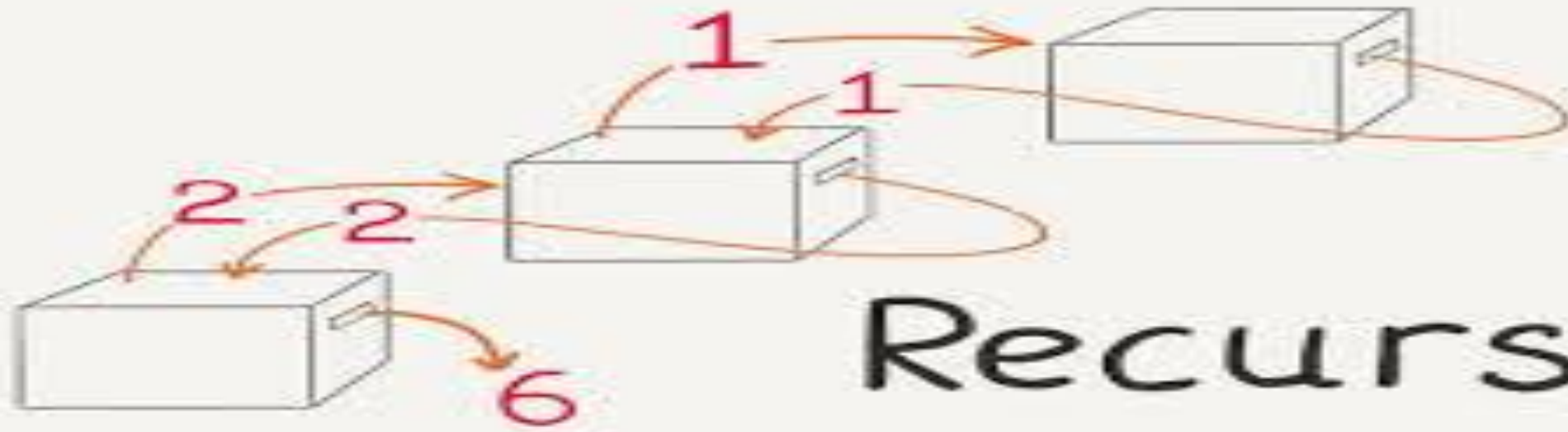
  while x not found
    if upperBound < lowerBound
      EXIT: x does not exists.

    set midPoint = lowerBound + ( upperBound - lowerBound ) / 2

    if A[midPoint] < x
      set lowerBound = midPoint + 1

    if A[midPoint] > x
      set upperBound = midPoint - 1

    if A[midPoint] = x
      EXIT: x found at location midPoint
  end while
end procedure
```

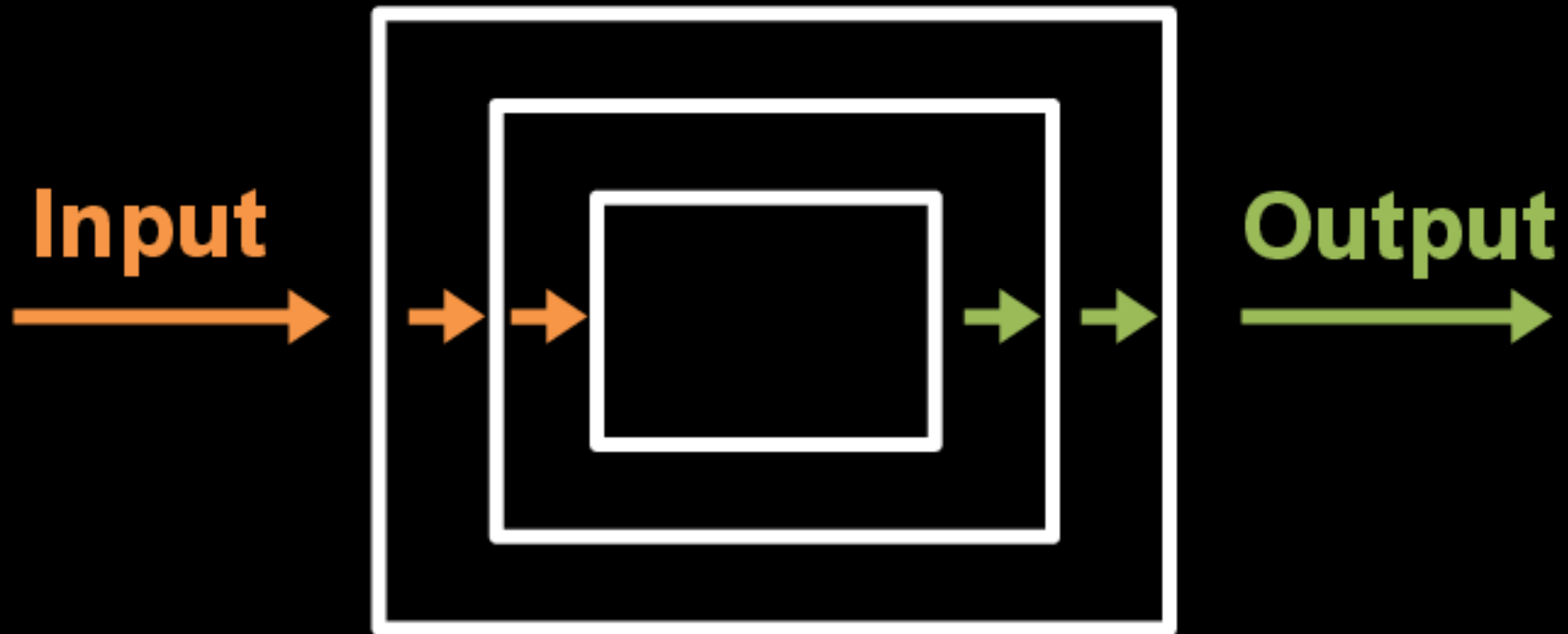


Recursion

Topics

1. Recursive definitions and Processes
2. Writing Recursive Programs
3. Efficiency in Recursion
4. Towers of Hanoi problem.

Recursion



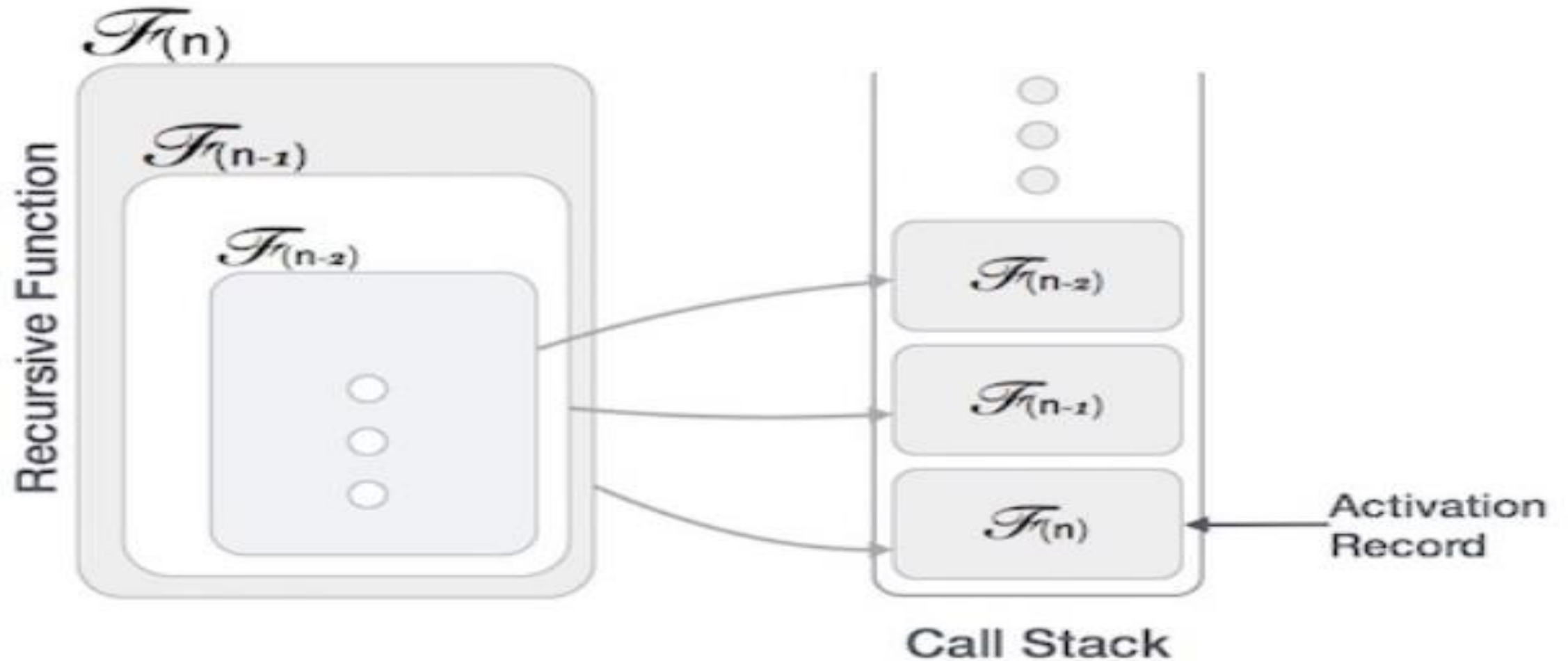
How does Recursion works?

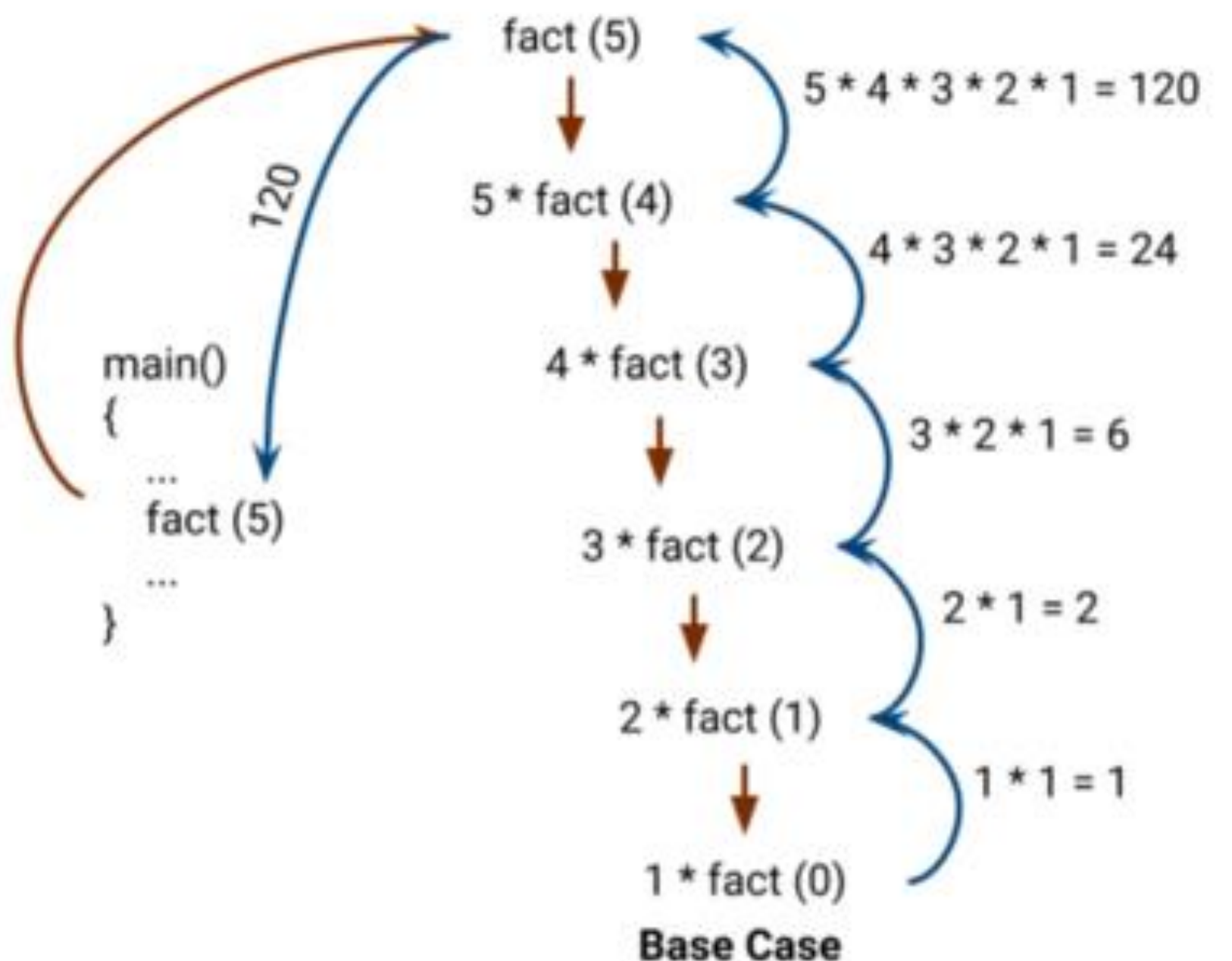
```
void recurse()
{
    ... ..
    recurse();
    ... ..
}

int main()
{
    ... ..
    recurse();
    ... ..
}
```

The diagram shows two function definitions. The first is `void recurse()` with a body containing three lines: `... ..`, `recurse();`, and `... ..`. The second is `int main()` with a body containing three lines: `... ..`, `recurse();`, and `... ..`. A line from the `recurse();` line in `main()` goes right and then up to point to the `void recurse()` line. Another line from the `recurse();` line inside the `recurse()` function goes right and then up to point to the `void recurse()` line. The text "recursive call" is placed between these two arrows.

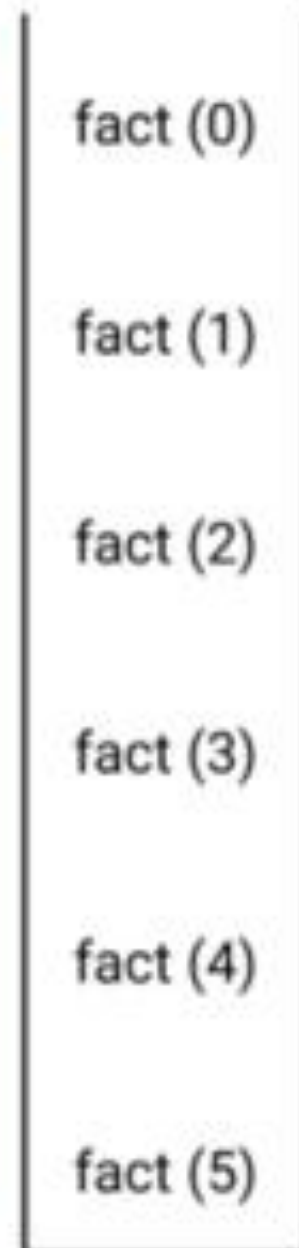
How Data Structure Recursive function is implemented?





Recursion stop here and return the solution directly!

Order of execution of function call



Order in which functions are returning values

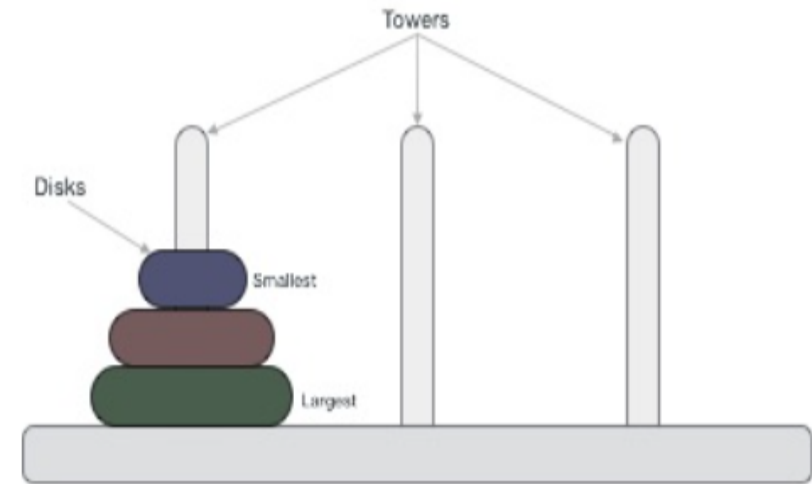
Recursion Call Stack

How memory is allocated to different function calls in recursion?

- When any function is called from main(), the memory is allocated to it on the stack.
- A recursive function calls itself, the memory for the called function is allocated on top of memory allocated to calling function and different copy of local variables is created for each function call.
- When the base case is reached, the function returns its value to the function by whom it is called and memory is de-allocated and the process continues.

What is Tower of Hanoi?

- A mathematical puzzle consisting of three towers and more than one ring is known as Tower of Hanoi.
- Tower of Hanoi
- The rings are of different sizes and are stacked in ascending order, i.e., the smaller one sits over the larger one. In some of the puzzles, the number of rings may increase, but the count of the tower remains the same.



Home Work

- Implement Tower of Hanoi Program
- No of Disk=3
- No of Disk=5
- No of Disk= n

Assignment 1

1. Print a series of numbers with recursive Java methods
2. Sum a series of numbers with Java recursion
3. Calculate a factorial in Java with recursion
4. Print the Fibonacci series with Java and recursion
5. A recursive Java palindrome checker

Thanks