DSA - Experiment 1

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AIM: Implement and Analyse Tower of Hannoi

THEORY: Tower of Hanoi is a mathematical puzzle where we have three rods (A ,B ,C and) and N disks. The smallest disk is placed on the top and they are on rod **A**. The objective of the puzzle is to move the entire stack to another rod in the same manner as it was in the start.

RULES OF THE GAME:

- 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 i.e. a disk can only be moved if it is the uppermost disk on a stack.
- No disk may be placed on top of a smaller disk.

Time complexity: $O(2^n)$

$T(n)=2T(n-1)+1$

Backward substitution:

$T(n-1) = 2T(n-2) + 2$

$T(n-2) = 2T(n-3) + 2$

$2T(n-2) = 2^2\ T(n-3) + 4$

$2^2\ T(n-3) = 2^3\ T(n-3) + 8$

$T(1)=0+2^n$

General equation is $T(n)=2^n$

Space complexity:O(n)

Space of recursive stack is of order n so space complexity is O(n)

CODE:

main.c

```c
#include<conio.h>
#include <stdio.h>

void tower(int n,char frompeg,char topeg,char auxpeg)
{
    if(n==1)
    {
        printf("Move disk 1 form peg %c to peg %c \n",frompeg ,topeg);
        return;
    }
    tower(n-1,frompeg,auxpeg,topeg);     //recall

     printf("Move disk %d form peg %c to peg %c\n",n,frompeg ,topeg);
     tower(n-1,auxpeg,topeg,frompeg);
}
int main()
{
printf("Divyesh khunt\n60009210116\n");
   int disk;
   char A,B,C;
   printf("enter no. of disks\n");
   scanf("%d",&disk);
    tower(disk, 'A','C','B' );
    return 0;
}
```

OUTPUT:

```
Divyesh khunt
60009210116
enter no. of disks
3
Move disk 1 form peg A to peg C
Move disk 2 form peg A to peg B
Move disk 1 form peg C to peg B
Move disk 3 form peg A to peg C
Move disk 1 form peg B to peg A
Move disk 2 form peg B to peg C
Move disk 1 form peg A to peg C


...Program finished with exit code 0
Press ENTER to exit console.
```

CONCLUSION:

Thus the code of tower of hannoi was analysed and implemented.

The time complexity of tower of hannoi is 2^n -1