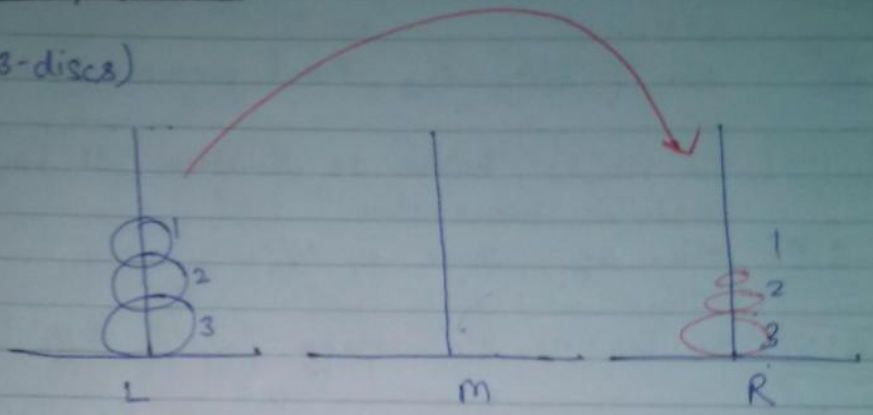
Condition : i) We can't put bigger disk on smaller disk
ii) We can move one disk at a time.

Towers of Hanoi :-

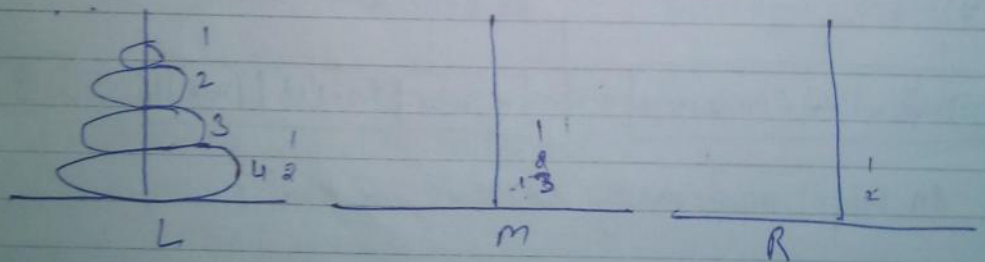
n = 3 (3-discs)



1. L-R
2. L-M
3. R-M
4. L-R
5. M-L
6. M-R
7. L-R

```
TOH (3, L, M, R)
{
    TOH (2, L, R, M)
    mov (L, R)
    TOH (2, M, L, R)
}
```

n = 4.



1 L-M
2 L-R
3 M-R
4 L-M
5 R-L
6 R-M
7. L-M
8 L-R.
9. M-R
10 M-L
11 R-L.
12 M-R
13 L-M
14 L-R
15 M-R.

```
TOH (4, L, M, R)
{
    TOH (3, L, R, M)
    mov (L, R)
    TOH (3, M, L, R)
```

R.P. :->

```
TOH (n, L, M, R)
{
  if (n==0)
      return ;
  else
  {
    TOH (n-1, L, R, M)   => T(n-1)
      mov (L, R)         => c
    TOH (n-1, M, L, R)   => T(n-1)
  }
}
```

R.R. :-

~~TOH(n, L, M, R) = { return if n=0 }~~

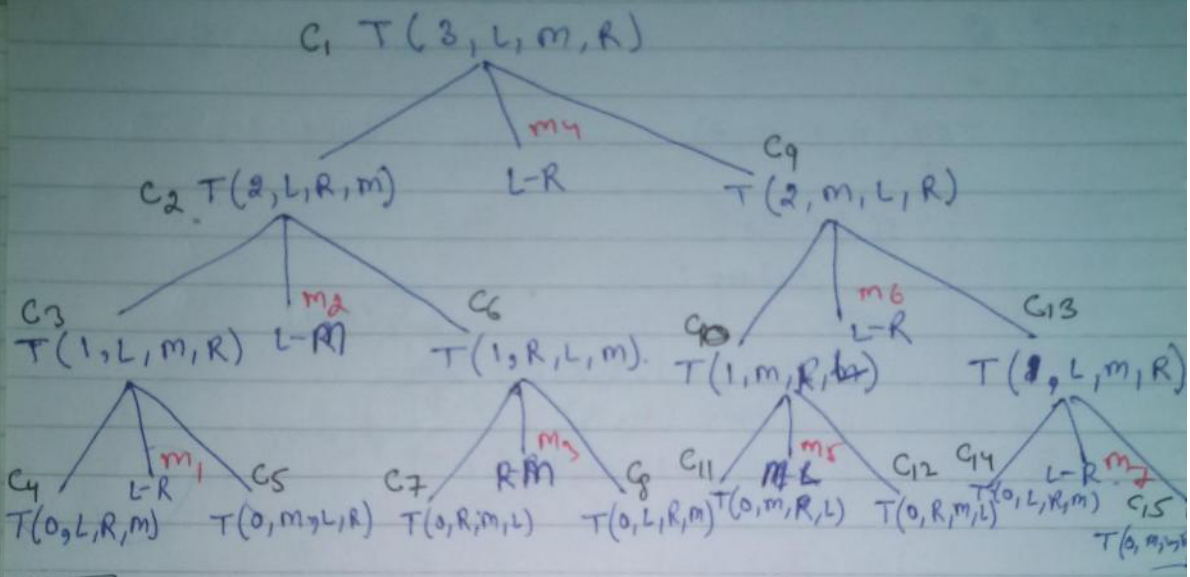
T.C. of TOH(n) →

$$T(n) = 2T(n-1) + c$$
$$= O(2^n)$$

S.C of TOH(n) →

n+1 level B.T.

$$= O(n)$$



Q:-1 In TOH(n), After how many function8 Call, first move will be taken place?

Soln: n+1 (After C_4 there is m_1)

Q:-2 In TOH(n), Is there ~~move~~ any move After last function Call?

Soln: No (After C_{15} no ~~move~~ move will there).

Q:-3 In TOH(n), Is any funchian Call after last move?

Soln: Yes (After m_7 there is C_{15})

Q:-4 In TOH(3), After how many funchian Call there is move from M-R.

Soln: 12 (After C_{12}, there is m_6)

Q:-5 In TOH(n), how many functions call are there?

Sol":

Total function Calls

T(0) = 1 $(2^{0+1}-1)$
T(1) = 3
T(2) = 7 $(2^{2+1}-1)$
T(3) = 15 $(2^{3+1}-1)$
T(4) = 31 $(2^{4+1}-1)$
T(50) = 2 * T(49) + 1

$T(n) = 2T(n-1)+1$
$= 2^{n+1}-1$

Total moves

T(0) = 0
T(1) = 1
T(2) = 3
T(3) = 7
T(4) = 15
T(5) = 31

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

Q:-6 In TOH(n), how many moves are there?

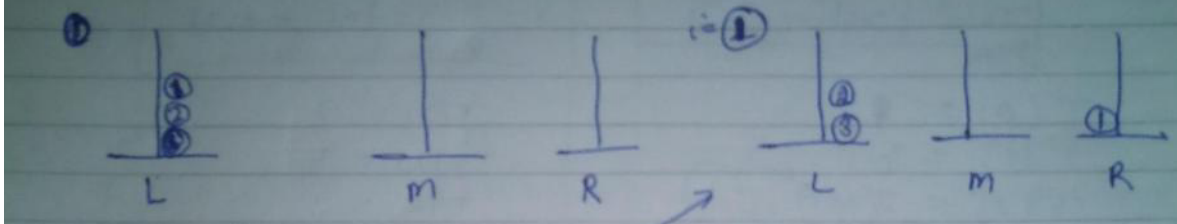
⇒ Iterative Algo:

① Calculate total # moves for n disks $= 2^n - 1$
② If # disks are even (n = even), interchange (M, R)
③ for i = 1 to total # moves:
if (i % 3 == 0)
mov disks b/w (M, R)
if (i % 3 == 1)
mov disk b/w (L, R)
if (i % 3 == 2)
mov disks b/w (L, M).

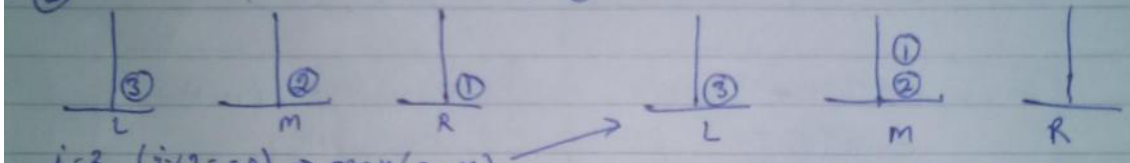
Continue: →

⇒ Iterative Algo for TOH :-

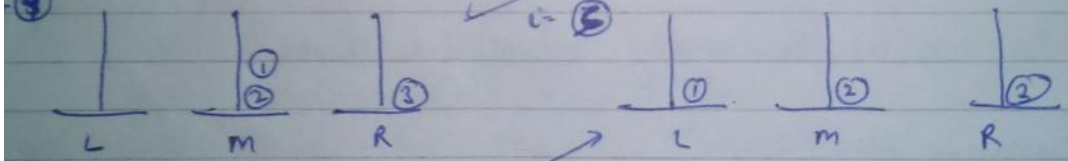
n = 3 (disk), So total # moves = 7



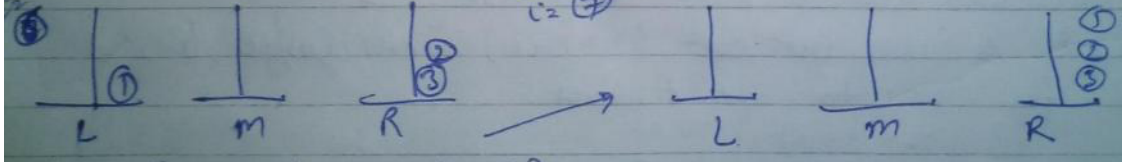
when i=1, (i%3==1) ⇒ mov(L→R) i=2, (i%3==2) ⇒ mov(L→M)



i=3, (i%3==0) ⇒ mov(R→M) i=4, (i%2==1) ⇒ mov(L→R)

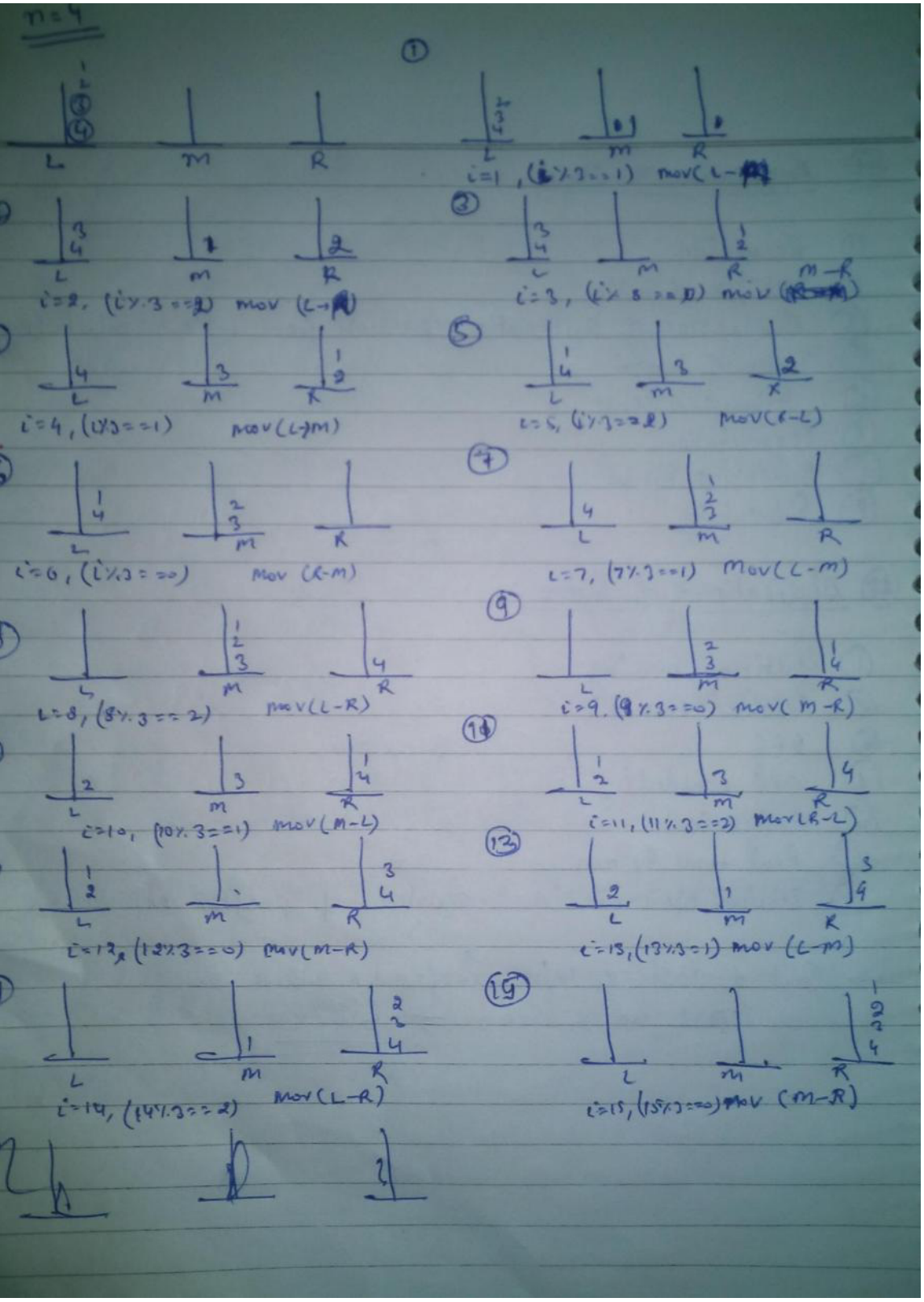


i=5, (i%3==2) ⇒ mov(M→L). i=6, (i%2==0) ⇒ mov(M→R)



i=7, (i%3==1) ⇒ mov(L→R)

n = 4


①
L
M
R
i=1, (i%3==1) mov(L-
②
i=2, (i%3==2) mov (L→
③
i=3, (i%3==0) mov (
m-R
④
i=4, (i%3==1) mov(L→M)
⑤
i=5, (i%3==2) mov(R-L)
⑥
i=6, (i%3==0) mov (R-M)
⑦
i=7, (7%3==1) mov(L-M)
⑧
i=8, (8%3==2) mov(L-R)
⑨
i=9, (9%3==0) mov(M-R)
⑩
i=10, (10%3==1) mov(M-L)
⑪
i=11, (11%3==2) mov(R-L)
⑫
i=12, (12%3==0) mov(M-R)
⑬
i=13, (13%3=1) mov (L-M)
⑭
i=14, (14%3==2) mov(L-R)
⑮
i=15, (15%3==0) mov (M-R)
⑯