Algorithm for factorial:

```
int fact (int n) {
    int x, y;
    if (n == 0)
        return 1;
    x = n-1;
    y = fact(x);
    return (n*y);
}
```

The process for the call: fact(4)

| n | x | y |
|---|---|---|

Initially

| n | x | y |
|---|---|---|
| 4 | * | * |

fact(4)

| n | x | y |
|---|---|---|
| 3 | * | * |
| 4 | 3 | * |

fact(3)

| n | x | y |
|---|---|---|
| 2 | * | * |
| 3 | 2 | * |
| 4 | 3 | * |

fact(2)

| n | x | y |
|---|---|---|
| 1 | * | * |
| 2 | 1 | * |
| 3 | 2 | * |
| 4 | 3 | * |

fact(1)

| n | x | y |
|---|---|---|
| 0 | * | * |
| 1 | 0 | * |
| 2 | 1 | * |
| 3 | 2 | * |
| 4 | 3 | * |

fact(0)

| n | x | y |
|---|---|---|
| 1 | 0 | 1 |
| 2 | 1 | * |
| 3 | 2 | * |
| 4 | 3 | * |

y = fact(0)

| n | x | y |
|---|---|---|
| 2 | 1 | 1 |
| 3 | 2 | * |
| 4 | 3 | * |

y = fact(1)

In first case return 1

Afterwards

n * y = y

| n | x | y |
|---|---|---|
| 3 | 2 | 2 |
| 4 | 3 | * |

y = fact(2)

| n | x | y |
|---|---|---|
| 4 | 3 | 6 |

y = fact(3)

| n | x | y |
|---|---|---|

y = fact(4) = 24

# N - Queen's Problem

→ $\boxed{Q}$ — 1×1 checker board

→ 2 queen's problem [2×2]

Case - 1           Case - 2
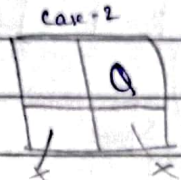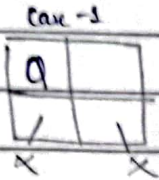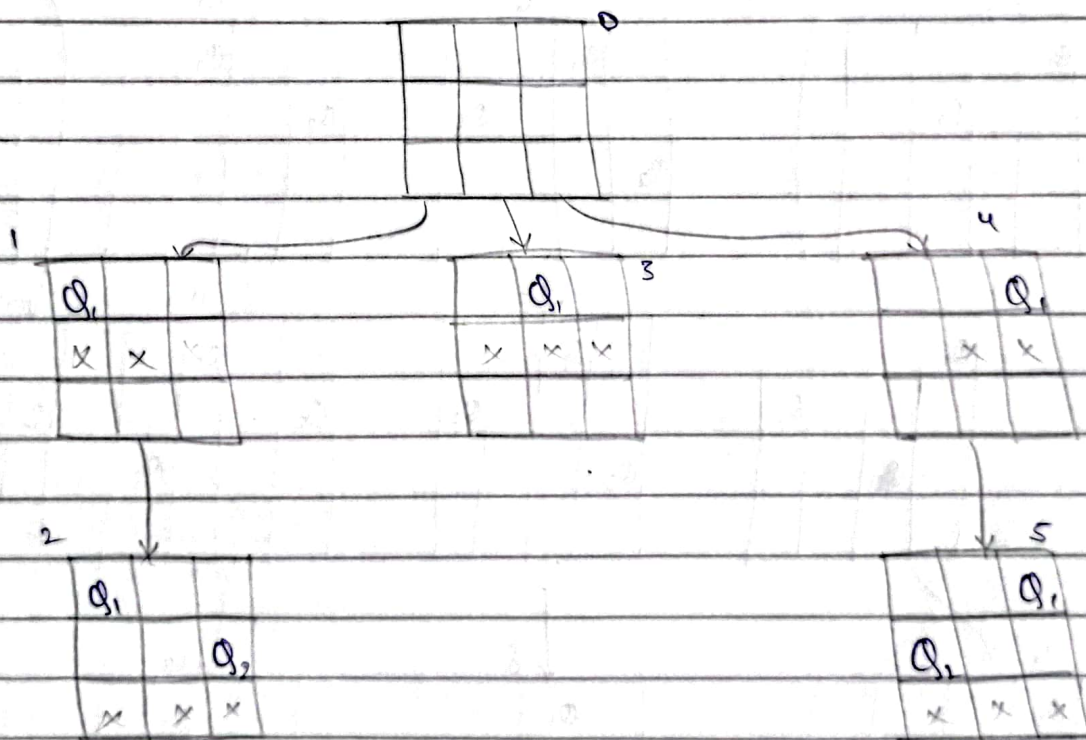


∴ 2 queen's problem has no-solution

Note : " These are called state space trees "

→ 3 queen's problem [3×3]



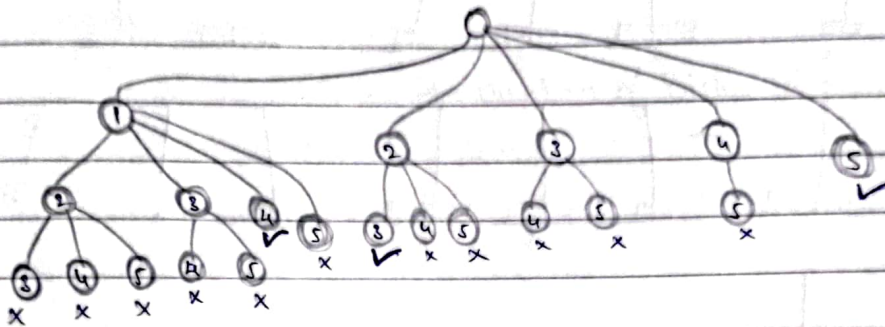∴ 3 - queen's problem have no Solution

→ 4 queen's problem

$\rightarrow$ 4 queen's problem

$0$

1    5    9    13

$Q_1$   × × $Q_2$ ×     $Q_1$ × × × $Q_2$     $Q_1$ × × ×     $Q_1$ ×

2    6    10    14

$Q_1$   $Q_2$   × × × ×     $Q_1$   $Q_2$   $Q_3$ × × ×     $Q_2$   $Q_1$ × × ×     $Q_1$   $Q_2$ × ×

3    7    11    15

$Q_1$   $Q_2$ × $Q_3$ × ×     $Q_1$   $Q_2$   $Q_3$ × × ×     $Q_2$   $Q_1$   $Q_3$ × × ×     $Q_1$   $Q_2$ ×

4    8    12    16

$Q_1$   $Q_2$   $Q_3$ × × × ×     $Q_1$   $Q_2$   $Q_3$   $Q_4$     $Q_2$   $Q_1$   $Q_3$   $Q_4$     $Q_1$   $Q_2$   $Q_3$ × × ×
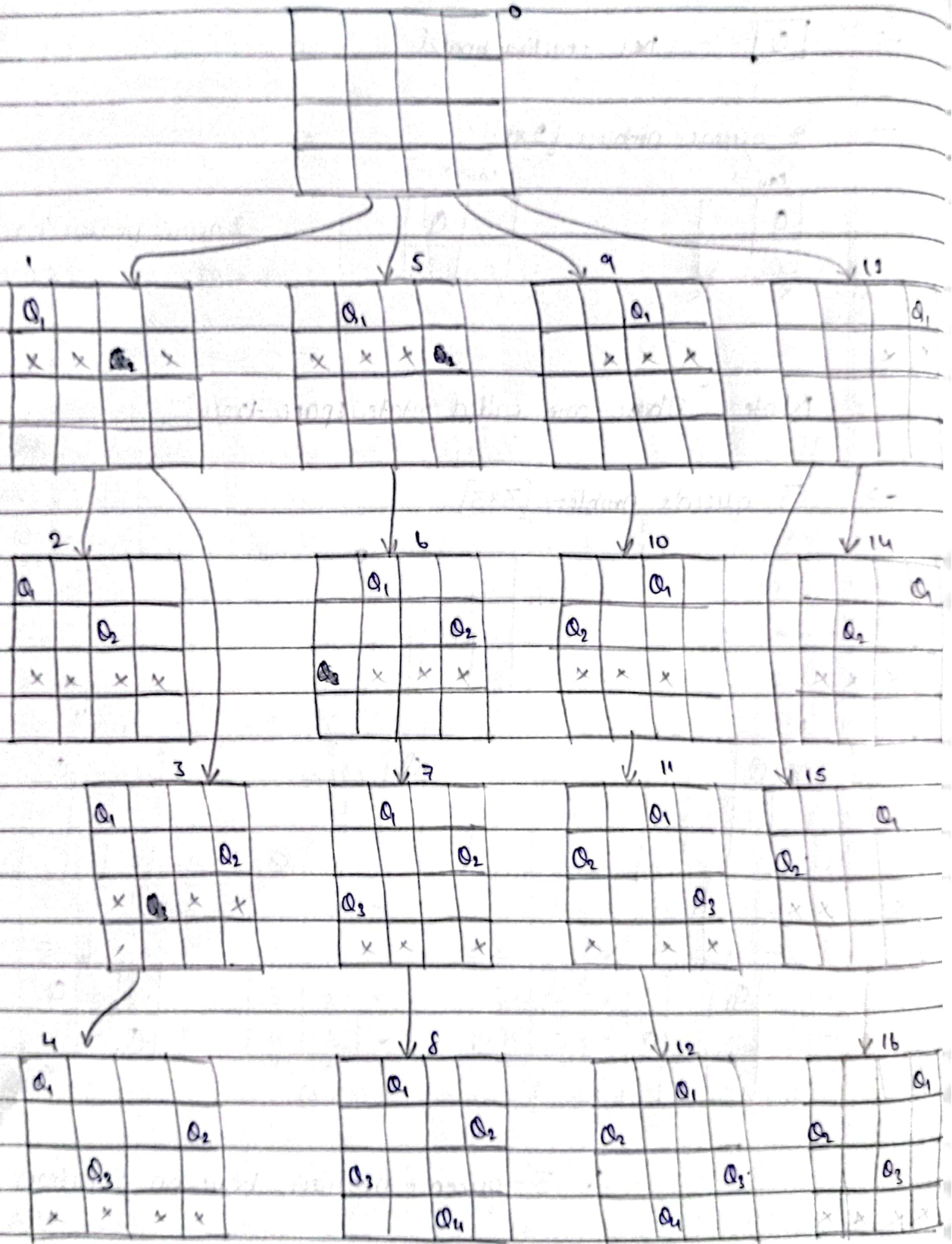
∴ 4 queen's problem has 2 solutions

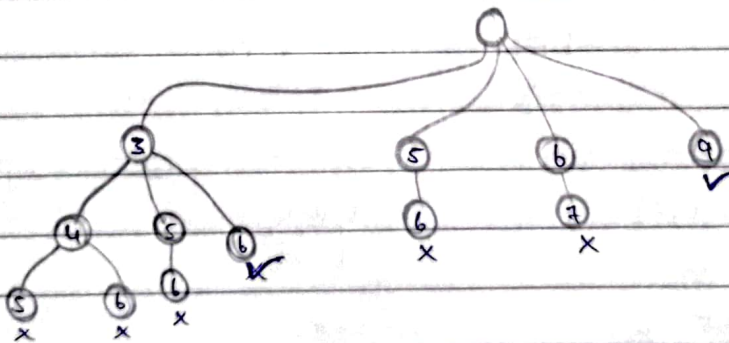- The approach of N-queen problem is generalized to the problem technique "Back tracking".

## Subset Sum Problem:

$$A = \{1, 2, 3, 4, 5\} \qquad K = 5$$
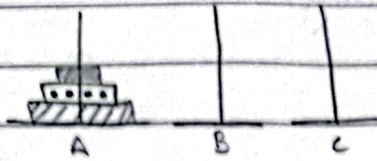


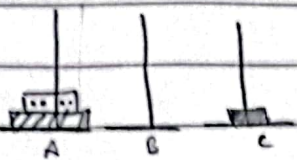Prune tree — Cutting Off.
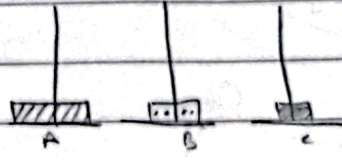
Eg:- $A = \{3, 5, 6, 9\}$ $\qquad K = 9$

# Tower of Brahma / Hanoi / Lucas

1)



Move from A to C all disks.
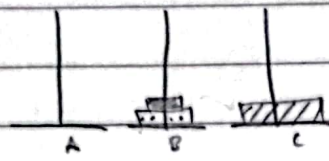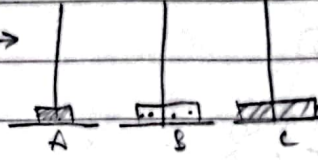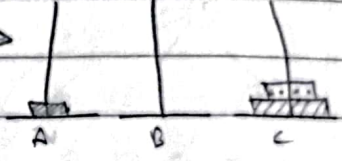
→ 

→ 

→ 

## Recursive tracing:

①
$t(3, A, C, B)$

②                                      ⑧                    ⑨
$t(2, A, B, C)$                    Print              $t(2, B, C, A)$

③                    ⑤  Print        ⑥                    ⑩              ⑫  Print        ⑬
$t(1, A, C, B)$            $t(1, C, B, A)$              $t(1, B, A, C)$              $t(1, A, C, B)$

④  Print                        ⑦  Print                          ⑪  Print                  ⑭  Print