

# Notes Constraint Satisfaction Problem :->

Date | | | | |

①

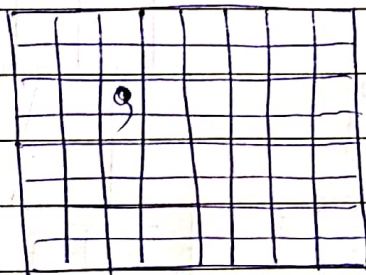
Node  $\rightarrow$  Black box

$\uparrow$   
CSP (Look Inside the node)

$\rightarrow$  Reasoning or inference can make the Search Easy.

$\rightarrow$  Only Successor-functions  
heuristic-functions  
goal-test()

② 8-Queen Problem:



DFS/BFS :  $64^8$  Combinations

- Factored Representation (Splitting things into smaller things)

- Internal Structure

- Set 8-Variables

$X_1, X_2, \dots, X_8$

$\rightarrow$  Position of a queen in a Row.

- No 2-Variables can be assigned the Same Value (constraints)

$8^8 = 16.7 \times 10^6$  Combinations

③ CSP Solution:

Assignments of values to the variables so that all constraints are satisfied.

CSP Inconsistent:

9 non attacking Queens on 8x8 boards

$\uparrow$   
To figure out this - Pigeon hole Principle



# Notes

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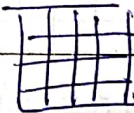
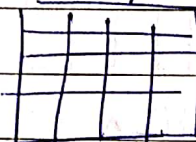
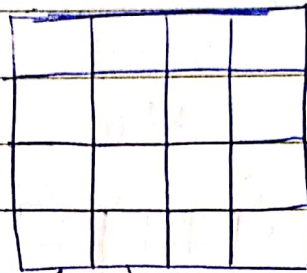
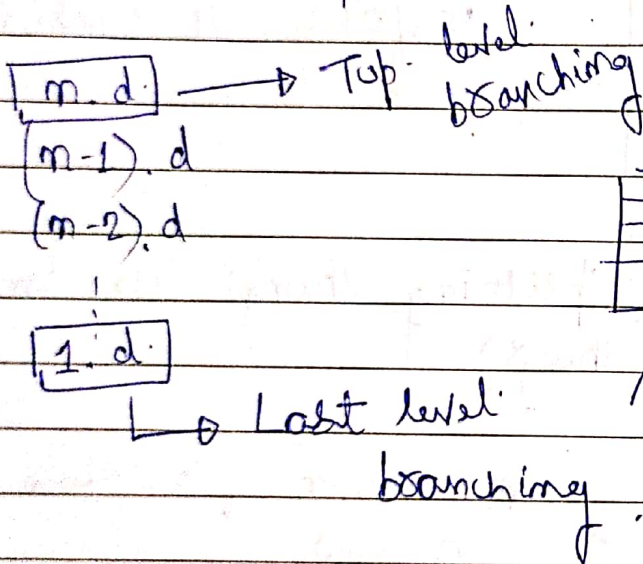
- Start with Empty Assignment
- Action: Assign a Variable Value
- goal test:

All variables Assigned, no constraints violation.

④  $m$ : Variables  
 $d$ : Possible values

$$m = 4$$

$$d = 4$$



Tree with  $m! d^m$  leaves

- ⑤ **ESP**
- Set of Variables  $\{x_1, x_2, \dots, x_m\}$
  - $x_i$ 
    - Domain  $D_i$

Discrete finite

- Set of Constraints  $\{c_1, c_2, \dots, c_k\}$

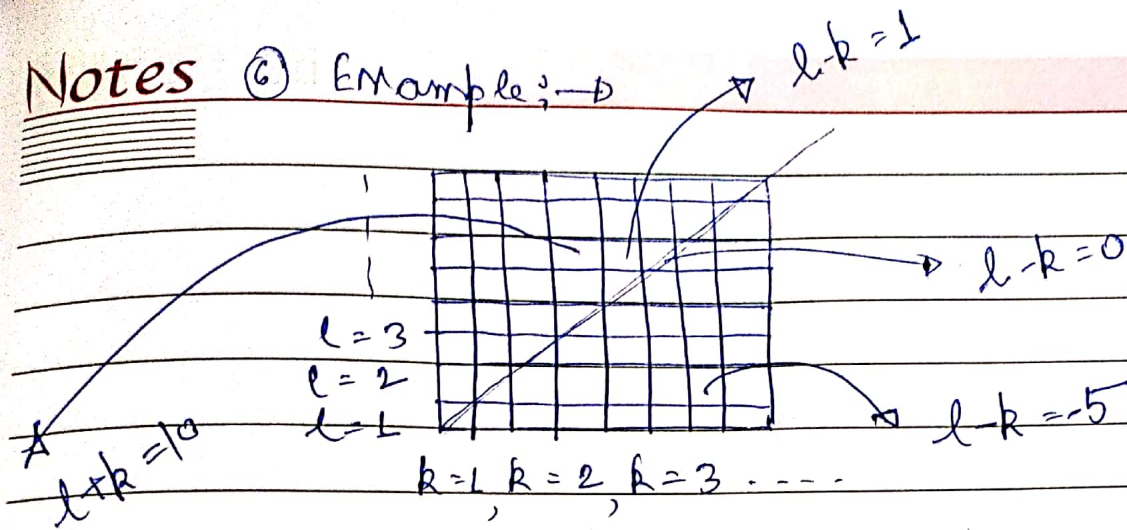
iv)  $C_k$

Imposes subset of Variables and specifies the allowable combinations of values of these variables

# Notes

⑥ Example:  $\rightarrow$

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## Formulation.

i) 8 - Variables  $x_i$ ,  $i = 1 \dots 8$  (one per Row)  
 Column for Queen in Row  $i$

ii) Domain :  $\{1, 2, \dots, 8\}$

iii) Constraints  
 -  $x_i \neq x_j$ , when  $j \neq i$  (No 2 Queens in the same column)

~~iv)~~ -  $\begin{cases} \text{i) } x_i - x_j \neq i - j \\ \text{ii) } x_i - x_j \neq j - i \end{cases}$

$\rightarrow$  No 2-Queens in the same diagonal