Artificial Intelligence

① Turing Test

To pass the turing test a computer must have :-

- NLP (Communication)
- Knowledge Representation (Store)
- Automated Reasoning (Draw Conclusions)
- Machine Learning (Detect New Circumstance)
- Computer Vision (Perceive)
- Robotics (Movement)

② System that think like Human	③ System that think Rationally
System that act like human ①	System that Act Rationally ④

② Cognitive Science & Psychology

③ Study of Logic Philosophy

+ Knowledge Representation & Reasoning

④ Rational Agent – One that acts to achieve the best outcome or when there is uncertainty the best expected outcome.

+ KR&R enables it to reach good decisions.

Production System : — Forward — Start at initial state & reach goal state
— Backward — Start at goal state & reach initial state

Specialized P.S. — Decomposable
Commutative

Decomposable → Initial Database can be split into separate components that can be processed independently

Commutative → Order in which set of applicable rules are applied to a database is important

Problem

Sol

Rule Sol → Solv Rule

Production System Involves :-

- Rules
- Database
- Control Strategy (Algorithms)

- Use blank space

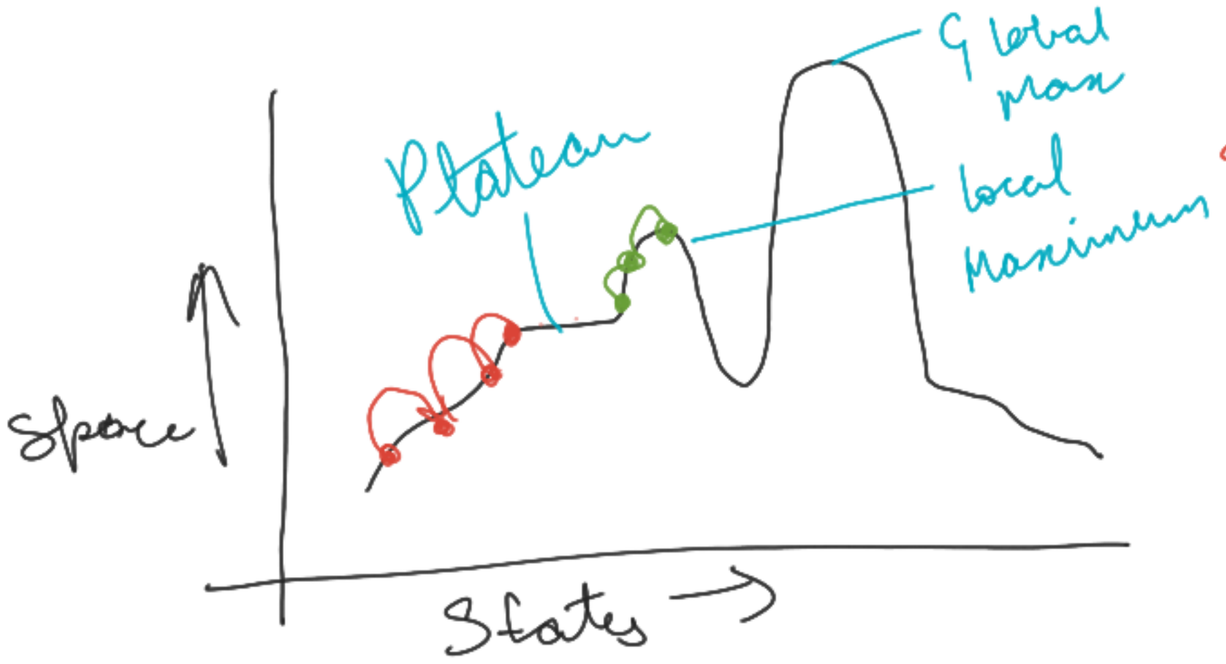
Rules - H / V

- Min Move

Greedy Best First Search
GBFS

Control Strategy

- Commutative
  - Irrevokable CS
    - Local Search
    - Genetic Algo
    - Hill Climb
- Decomposable
  - Tentative CS
    - Graph Search
      - Game playing
        - Adversial
          - Minimax
          - αβ
      - UnInformed
        - BFS
        - DFS
      - Heuristic
        - Informed
          - A*
          - AO*
          - GBFS



State Space Search

No of states a problem can go

Uninformed CSC ↓ RAC ↑

Informed CSC ↑ RAC ↓

Hill Climb

Computational Cost

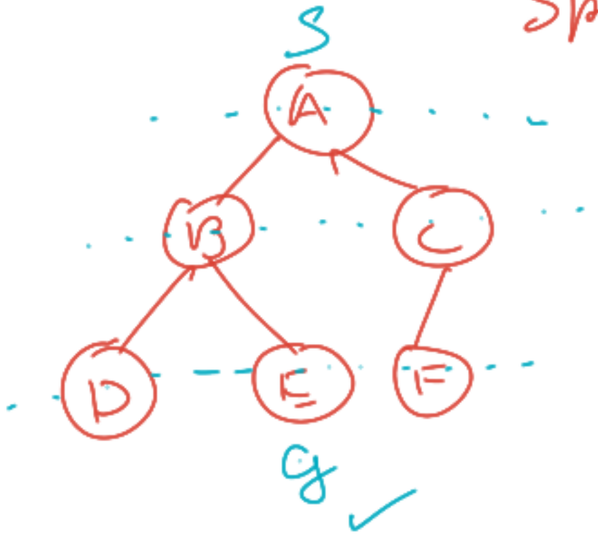
Rule Application Cost

Cost of Strategy Cost (Algo Cost)

BFS (Uninformed)

- Uninformed
- FIFO (Queue)
- Complete
- Optimal Result
- $O(V+E) \equiv O(b^d)$ Time

Space $O(b \times d)$

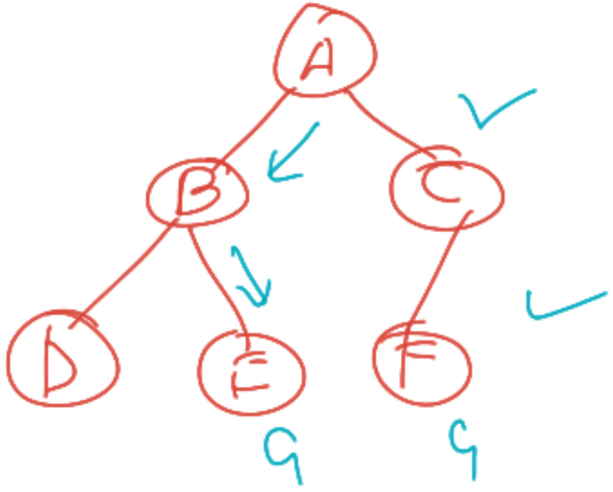


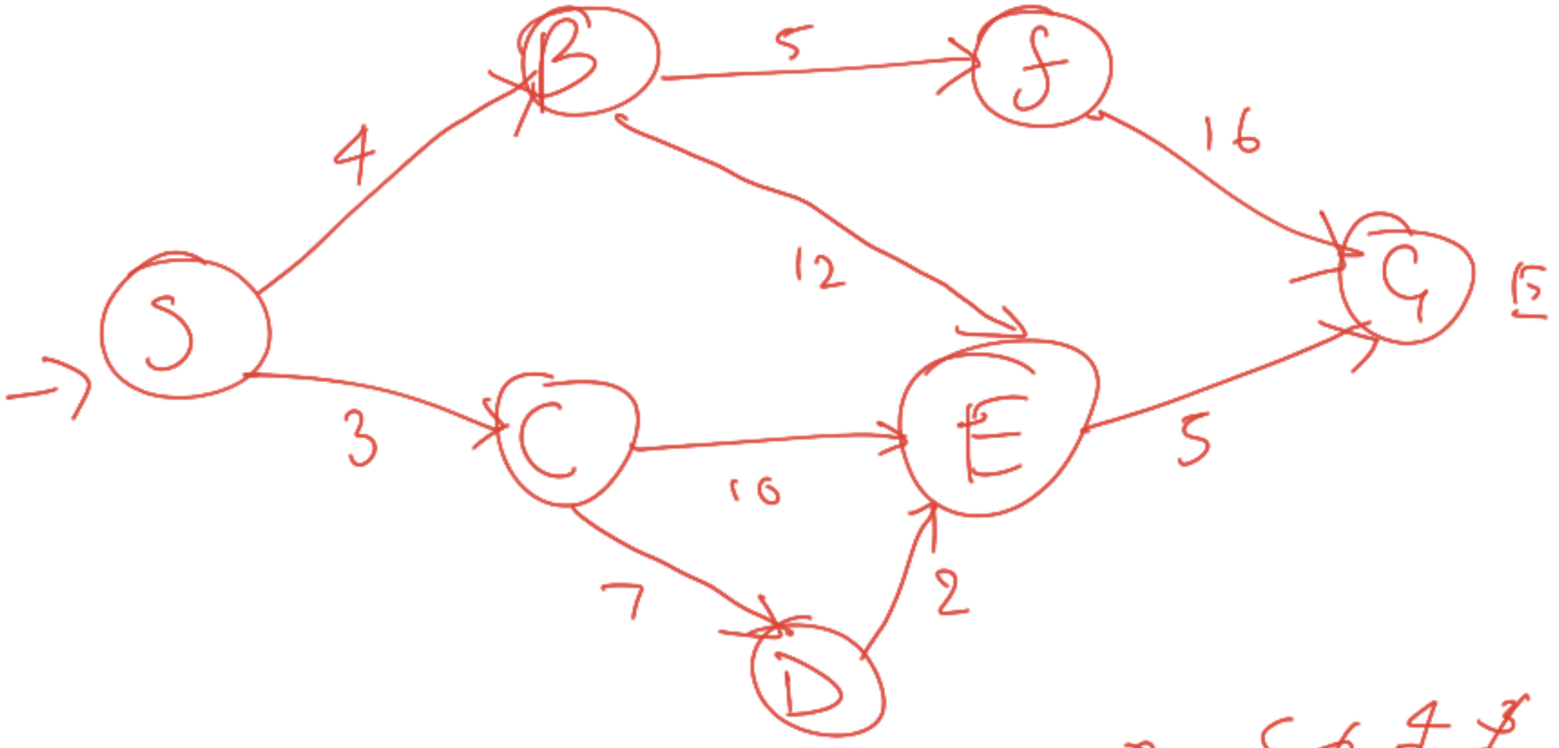
B → D
Q → S

DFS (Uninformed)

- Stack (LIFO)
- Deepest Node
- Incomplete
- Not Optimal
- $O(V+E) \equiv O(b^d)$

Space $O(b \times d)$





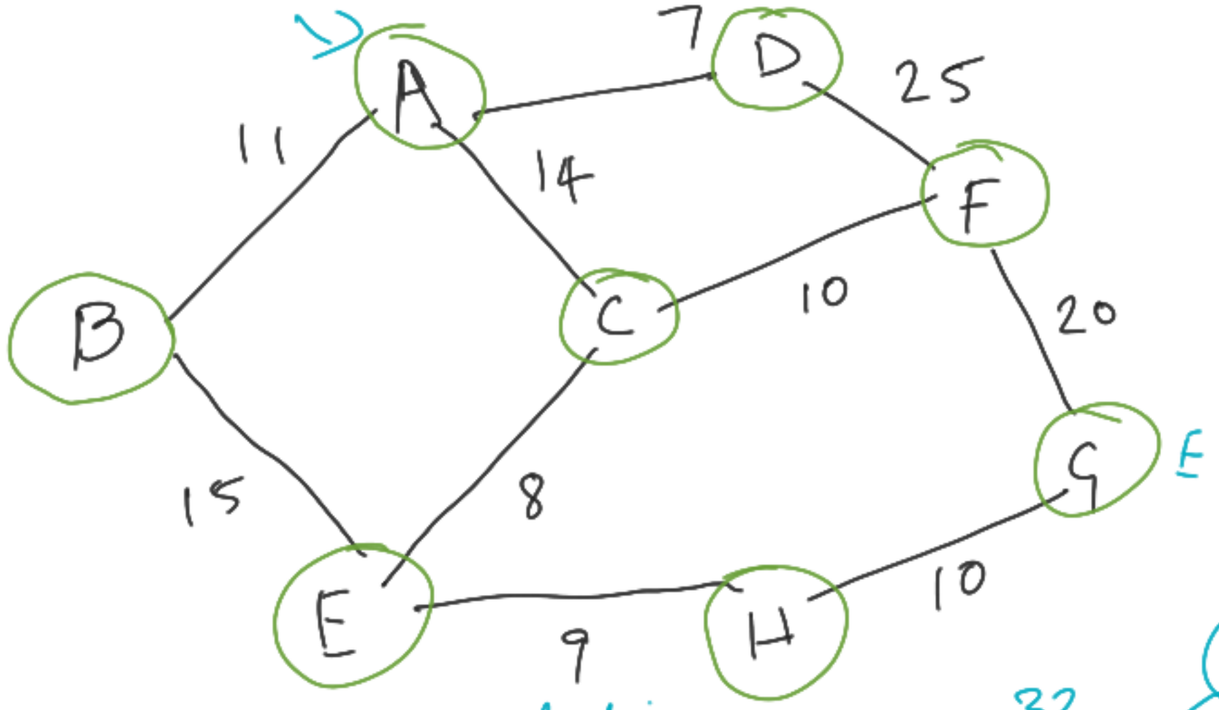
$O = \{S^0, B^4, F^{13}, E^{12}, G^{17}\}$

$C = \{S^0, C^3, D^{10}, E^{12}, G^{07}\}$

Informed → Heuristic → Evaluation function $d(n) + w(n)$

depth weight

Best First Search → Greedy



Greedy gives solution

But not optimal solution

O { ~~A~~, B, ~~C~~, D, E, ~~F~~, ~~G~~)

C { A, C, F, G)

Heuristic

A → G = 40

B → G = 32

C → G = 25

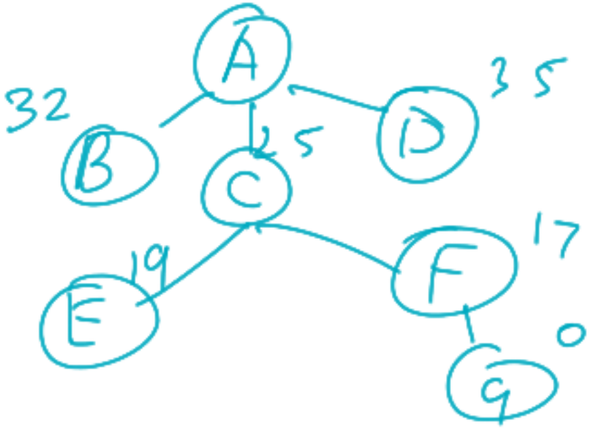
D → G = 35

E → G = 19

F → G = 17

H → G = 10

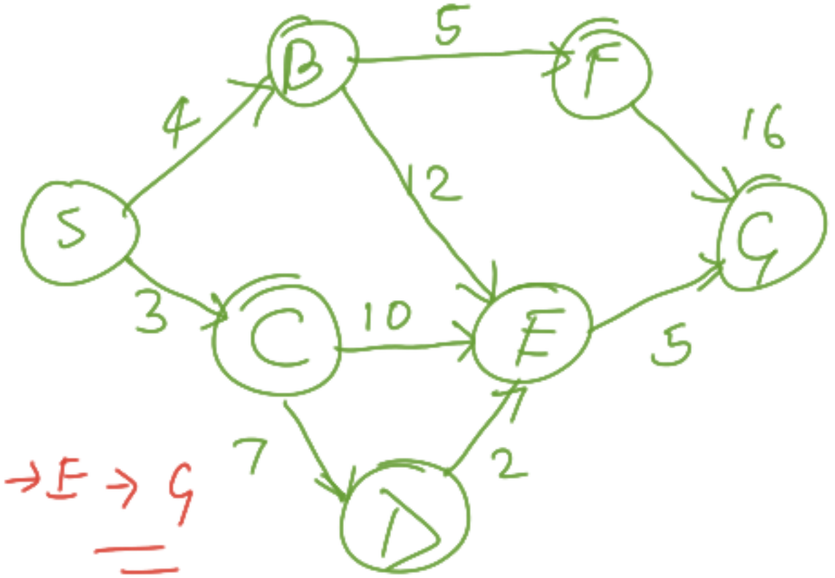
G → G = 0



A* $f(n) = g(n) + h(n)$

Actual cost from start to n

Estimation cost from n to goal



P = S → C → D → E → G

~~S → B~~

$f(S) = 0 + 14 = 14$

S → B: 4 + 12 = 16

S → C: 3 + 11 = 14

SB → F: 9 + 11 = 20

SB → E: 16 + 4 = 20

SC → D: 10 + 6 = 16

SC → E: 13 + 4 = 17

SCD → E: 12 + 4 = 16

SCE → G: 18

SCDE → G: (3 + 7 + 2 + 5) + 0 = 17 ✓

Heuristic

S = 14

B = 12

C = 11

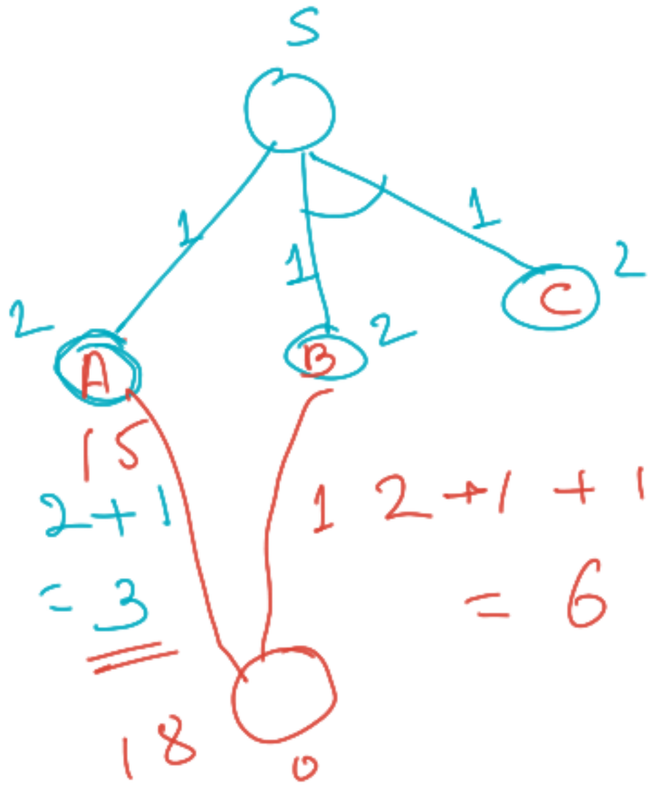
D = 6

E = 4

F = 11

G = 0

AO* (And OR Graph) – doesnot explore all the possible paths

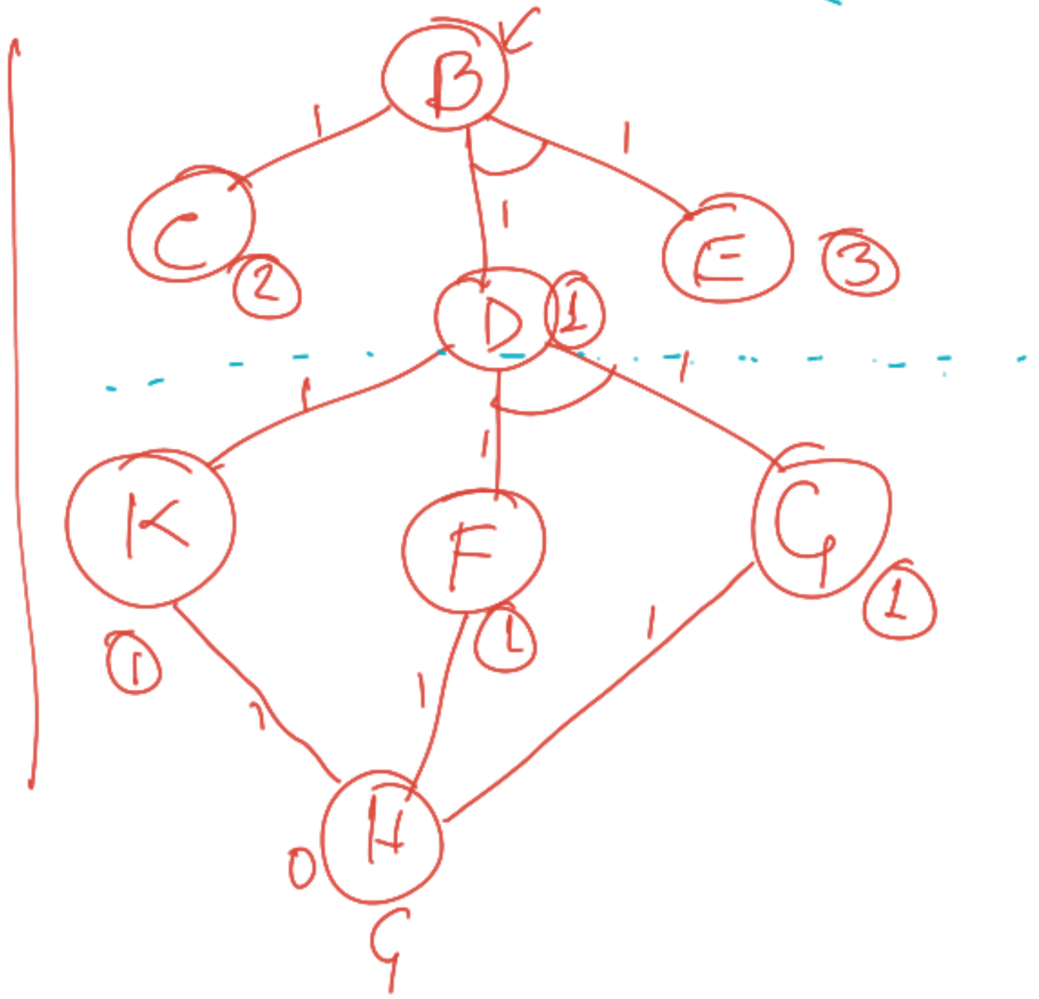


A — or — B

B — and — C

1 2+1 + 1 + 2

= 6 + 1 = 7



Genetic Algorithm

1. Chromosomes
2. fitness fn (heuristic)
3. Crossover
4. Mutation

] loop

Population

10 0 1 0 0 1 1
1 1 0 0 1 1 0 0
1 0 1 0 1 0 1 0

→ Chromosome

→ Genes

Parent 1 : 1 0 0 1 0 0 1 1

Parent 2 : 1 1 0 0 1 1 0 0

} one point crossover

Child 1 : 1 0 0 1 1 1 0 0

Child 2 : 1 1 0 0 0 0 1 1

mutation →

1 1 0 0 0 0 1 1

1 1 0 0 0 1 1 1

Eg 2

1 0 1 0 1 0 1 0
1 0 0 1 1 0 0 1

1 0 1 1 1 0 0 1
1 0 0 0 1 0 1 0

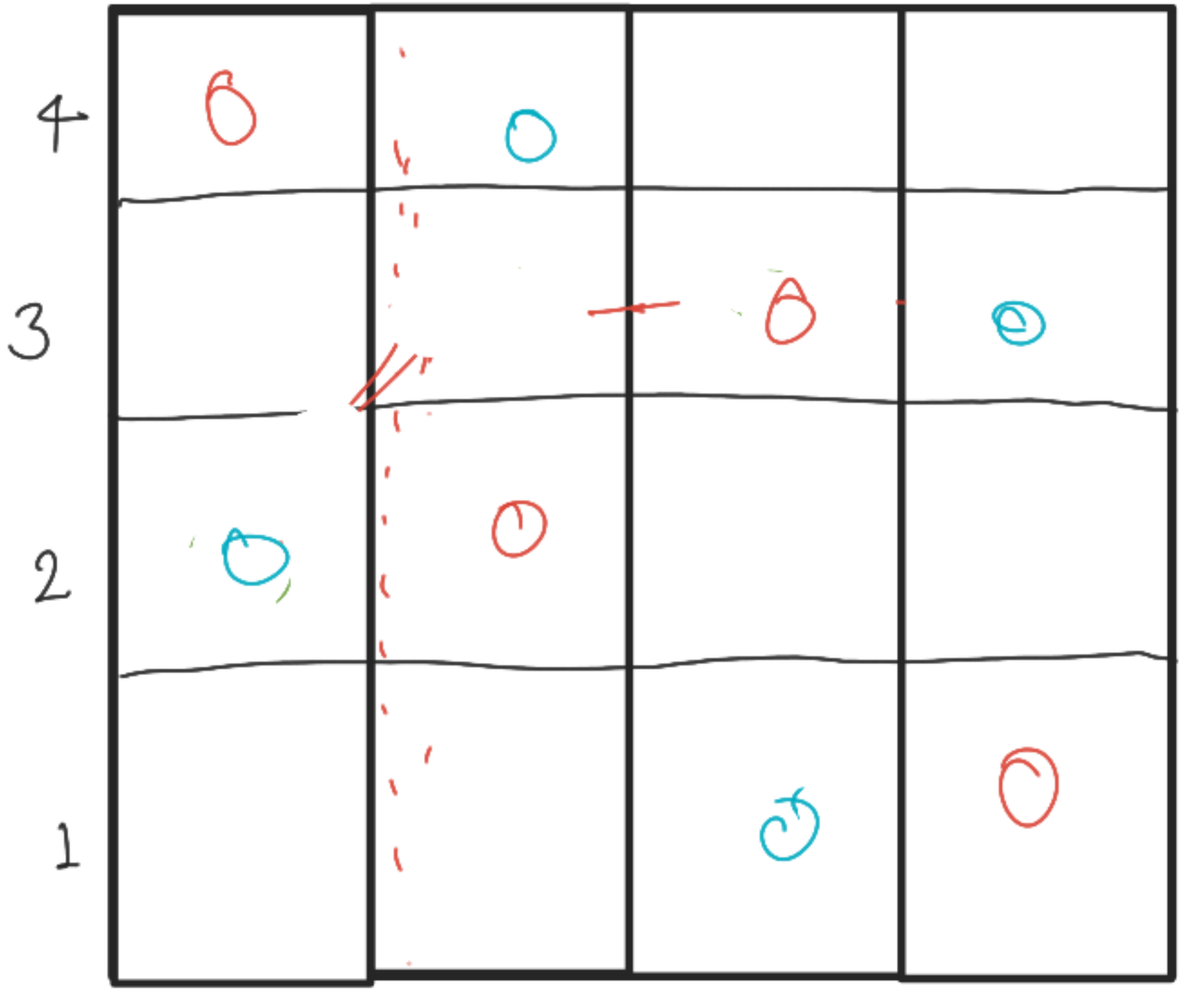
Two point Crossover

Eg 3

1 0 1 0 1 0 1 0
1 0 0 1 1 0 0 1

1 0 1 1 1 0 1 0
1 0 0 0 1 0 0 1

4 - Queen (Genetic Algorithm)



fitness = 2 + 1 + 1 + 0

f(n) = 4

2110 ✓✓

2313

$f(n) = 2 + 1 + 1 + 0 = 4$

$f(n) = 3 + 1 + 1 + 0 = 5$

fitness function :-

$2 + 1 + 1 + 0 = 4$

But Best = $3 + 2 + 1 + 0 = 6$

2313 = 2331 → 2431

4231 4213 → 4213

2413 ✓

2413

4231

$B \to E = 4$
$B \to D = 2$] — 6

$B \to C = 3$

$B \to D \to F = 8$ (F)

$B \to D \to G = 8$ (F)

} 16