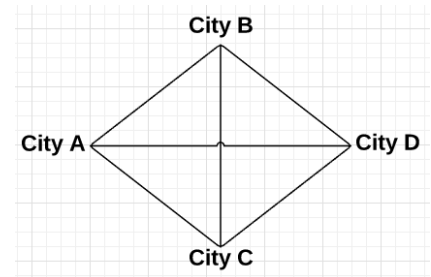


Control Strategy (CS)

- Desired Characteristics
 - 1) Systematic
 - A sequence of moves that transforms the state space in a manner that is not random and hopefully leads to a goal
 - 2) Cause motion
 - (Do not want to end up with infinite loop)
Example of that is the water jugs problem
[Fill up the jug and pour the water out and so on]
 - 3) Efficient
 - Minimize “cost”

Example**A traveling Salesman Problem (TSP)**

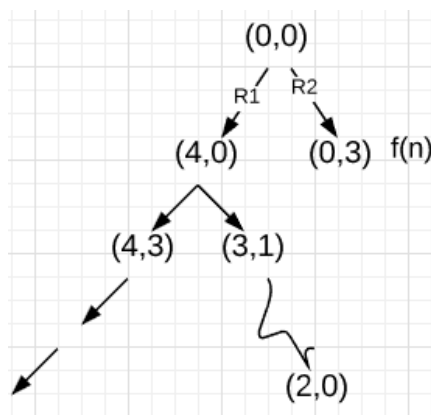
A starting city (A) have to visit each city exactly once and return to start city.



1. Systematic (enumerate all paths)
2. Cause motion
3. Efficient ?

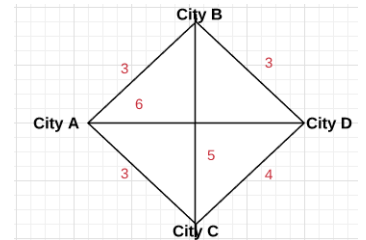
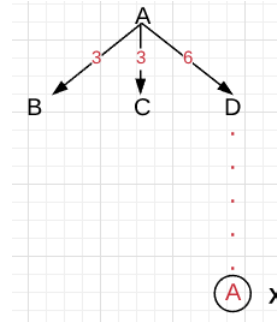
Propose the following

- Control strategy
- Solution generation
 - Search process that is based on expanding the state space



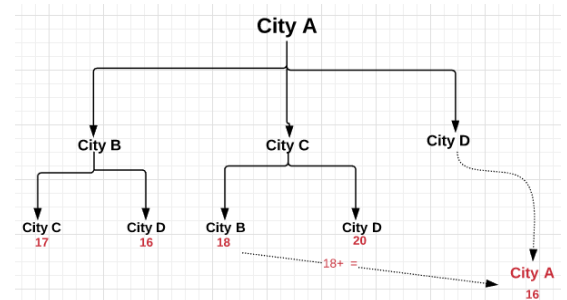
Traveling Salesman Problem (TSP)

- Start with city A and expand this node
- At each child node compute the accumulated distances so far
- Select partial path whose accumulated distances is the minimum

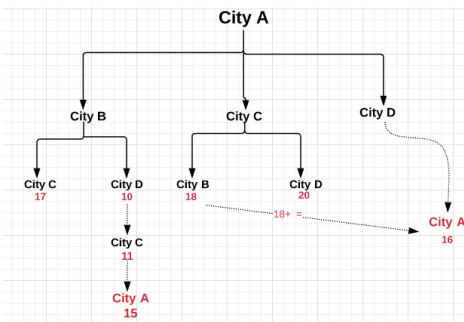


Branch and bound algorithm (B&B)

Stop the search process if there is a full path whose total cost is \leq the cost of all the remaining partial paths



- Number of node (1.26^n)

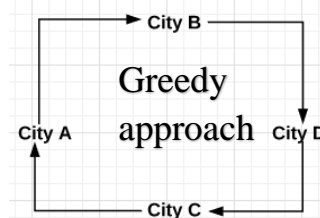


Does this technique guarantee the optimality?

Heuristic

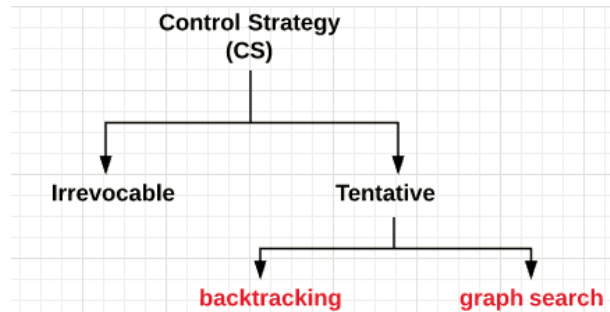
A measure technique that allows to solve the problem more efficient sometime at expense of optimality (sometime not so)

- Branch and bound (B&B)
- Greedy \rightarrow nearest neighbor



Classification of Control Strategy

- Irrevocable
- Tentative
 - Graph search
 - backtracking

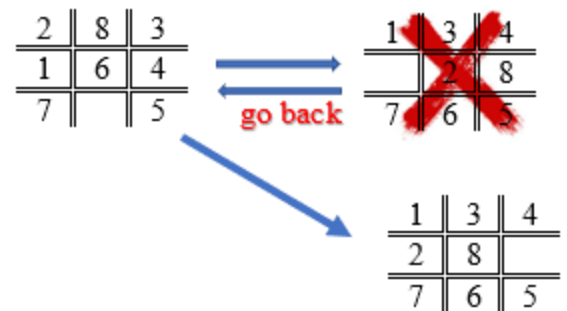


Irrevocable

- A production rule is applied and cannot be undone (such as chess)

Tentative

- A provision is made to go back to previous state(s) and apply different move.



Question

What are the different between backtracking tentative and graph search?

Irrevocable

Example

8 puzzle problem

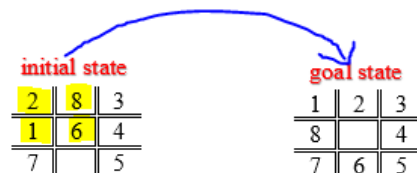
CS define the following function

$f(s) = \rightarrow$ (# of misplaced tiles with respect to the goal state description)

Negative number

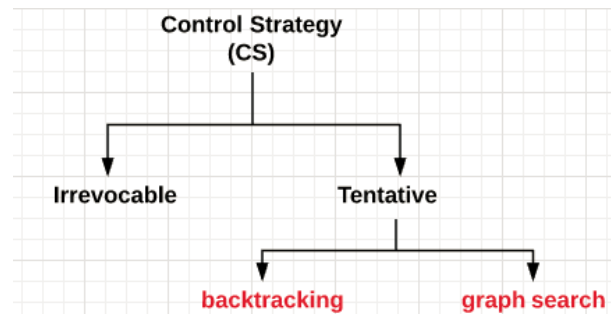
How many tiles misplaced!

The value of function $f(s) = -4$



Classification of Control Strategy (CS)

- Irrevocable
- Tentative
 - Graph search
 - backtracking



Irrevocable

Example

8 puzzle problem

CS define the following function

- $f(n) = - (\text{\# of misplaced tiles})$
- n – board configuration

$$f(n) = -4$$

→ heuristic merit of a node in tree graph

initial state

2	8	3
1	6	4
7		5

goal state

1	2	3
8		4
7	6	5

initial state

2	8	3
1	6	4
7		5

goal state

1	2	3
8		4
7	6	5

Initial state

2	8	3
1	6	4
7		5

Up

2	8	3
1		4
7	6	5

Up

2		3
1	8	4
7	6	5

L

1	2	3
1	8	4
7	6	5

D

1	2	3
1	8	4
7	6	5

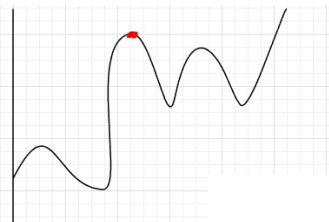
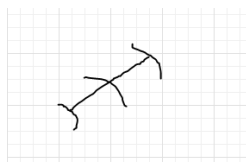
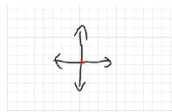
R

Goal state

1	2	3
8		4
7	6	5

Hill climbing

- local min / max
- plateau
- ridges



Value of function increasing

1	2	5
7	4	
8	6	3

-2

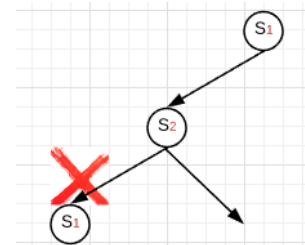
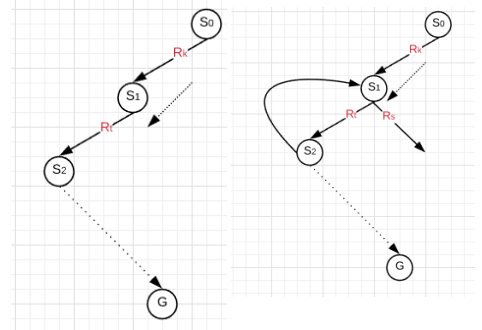
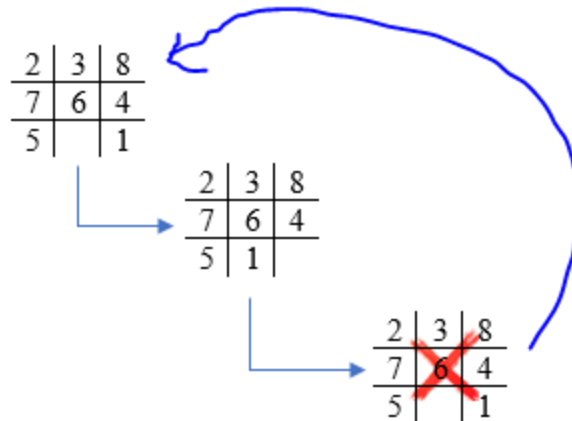


1	2	3
7	4	
8	6	5

-3

Tentative

- Backtracking
 - Criteria for backtracking
 1. If you encounter a state on your current Path that's already on it

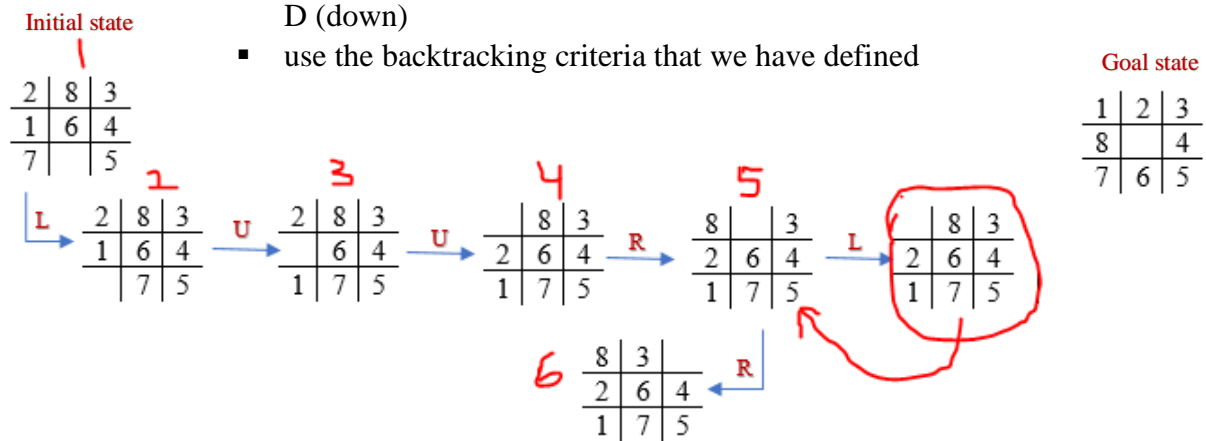


2. You have applied a certain numbers of moves (6 or 5 or 4) and that does not result in the goal state or improvement
3. There are no more rules to apply to the current state

Example



8 puzzles L U R D → Order which moves are made

- always move L (left) first , then if possible, go U (up) then R (right) then D (down)
- use the backtracking criteria that we have defined



Queen Problem

- Present as AI production system
 - Database (DB)
 - Operators
 - Control Strategy (CS)

	<i>X</i>		
			<i>X</i>
<i>X</i>			
		<i>X</i>	