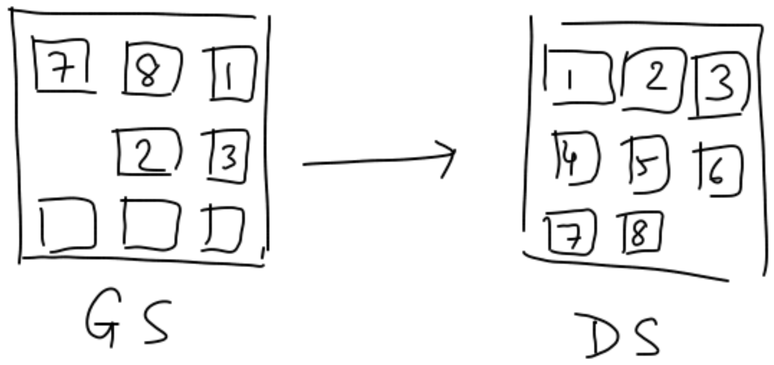
Lec 24: Classical Methods of AI

AI for problem solving



Given State → Desired state

sequence of decisions

- Knowledge based
  - memory based
  - rule based
- search

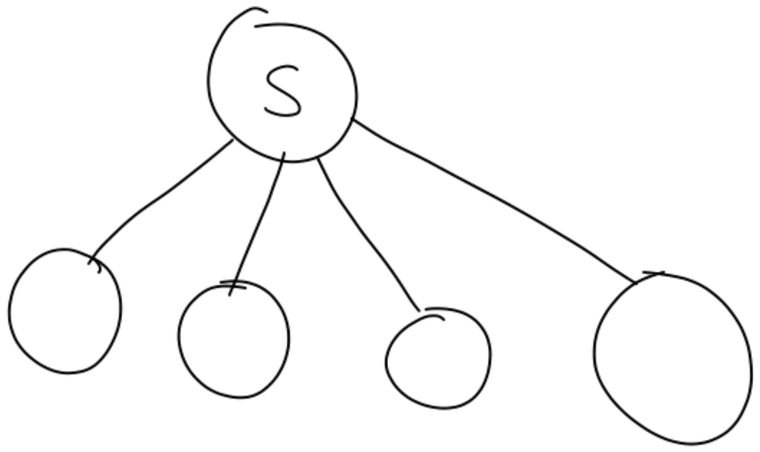
knowledge: exploit additional knowledge from experiences.

memory: experiences are stored
Next time a problem instance occurs start from the nearest to solve.

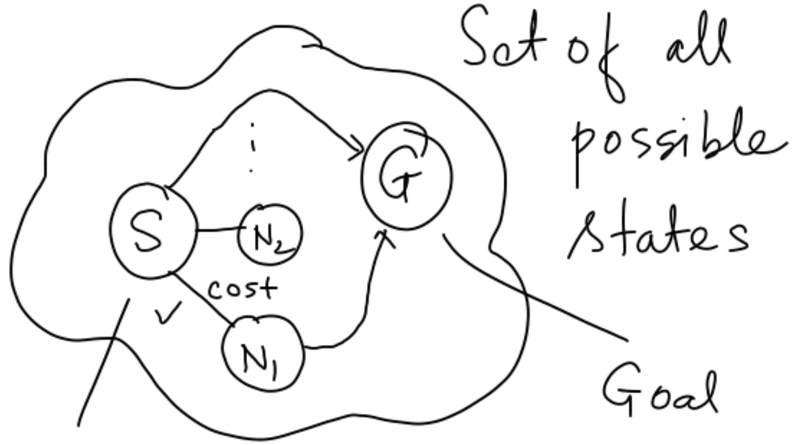
rule: domain expert formulates a rule from the experiences.

Search: The first approach by any intelligent agent.

— No past experiences are available.



State Space Search



Set of states = $\{s_1, s_2, \ldots, s_m\}$

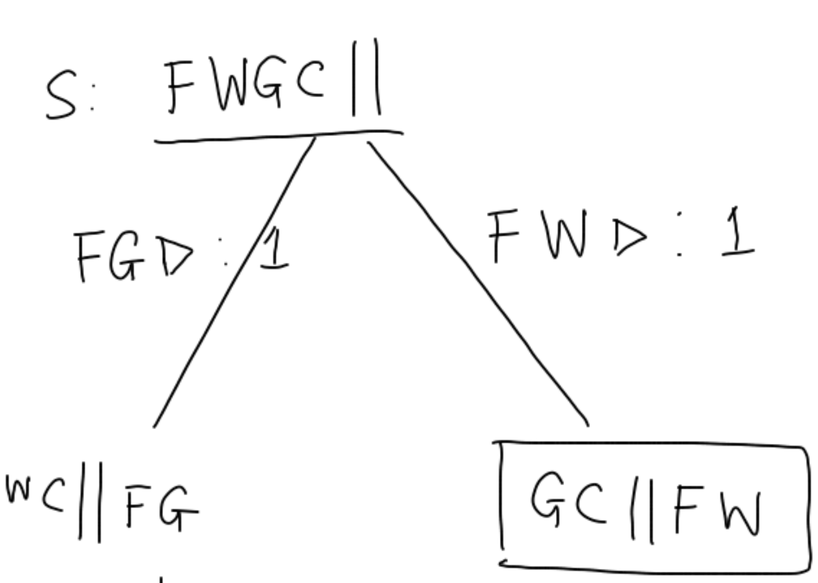
actions(s) : action at a state s

neighbors(s)

isGoal(s)

Ex. River crossing puzzle

Farmer
Wolf
Goat
Cabbages



Farmer takes the Goat to the other side

◁F: 1

FWC||G

G: ||FWCG

Search methods need

① Abstraction:

- states
- actions
- neighbors
- goal
- cost

② Algorithm development

General anatomy of a search algorithm

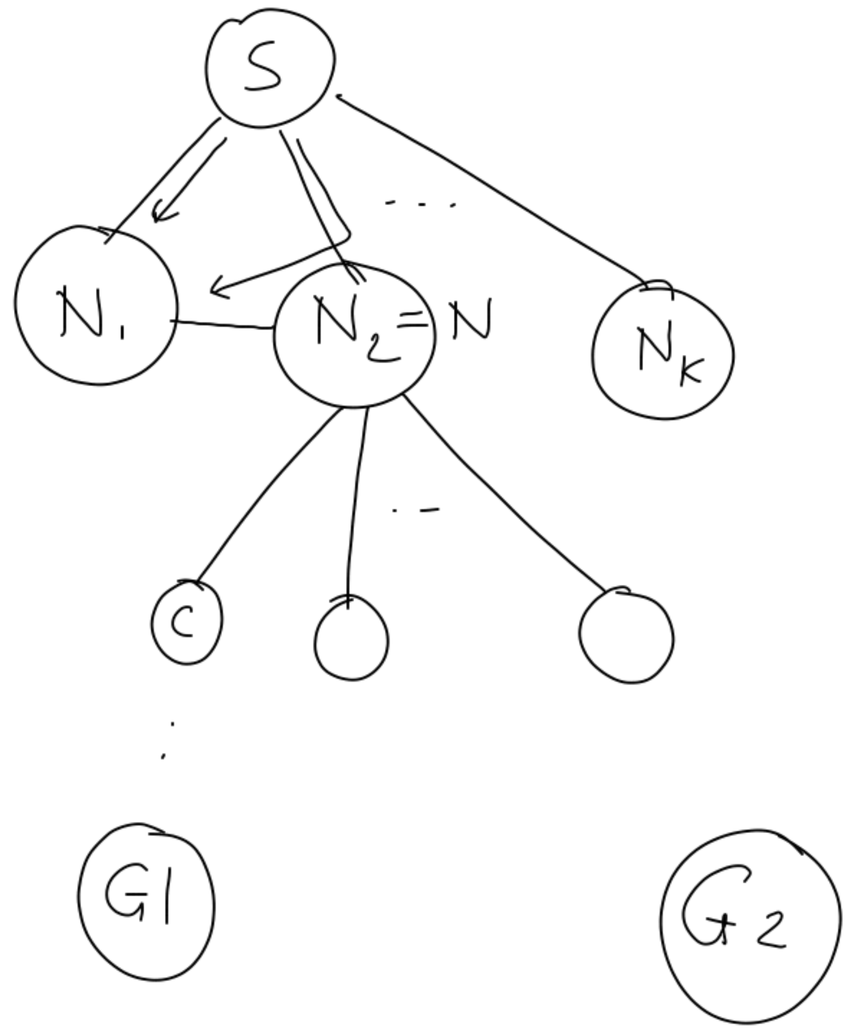
Visited states
S

Curr State
N

$N = S$

For state $c \in$ neighbors(N):

    if is Goal(c):
        do something
    else:
        do something else.

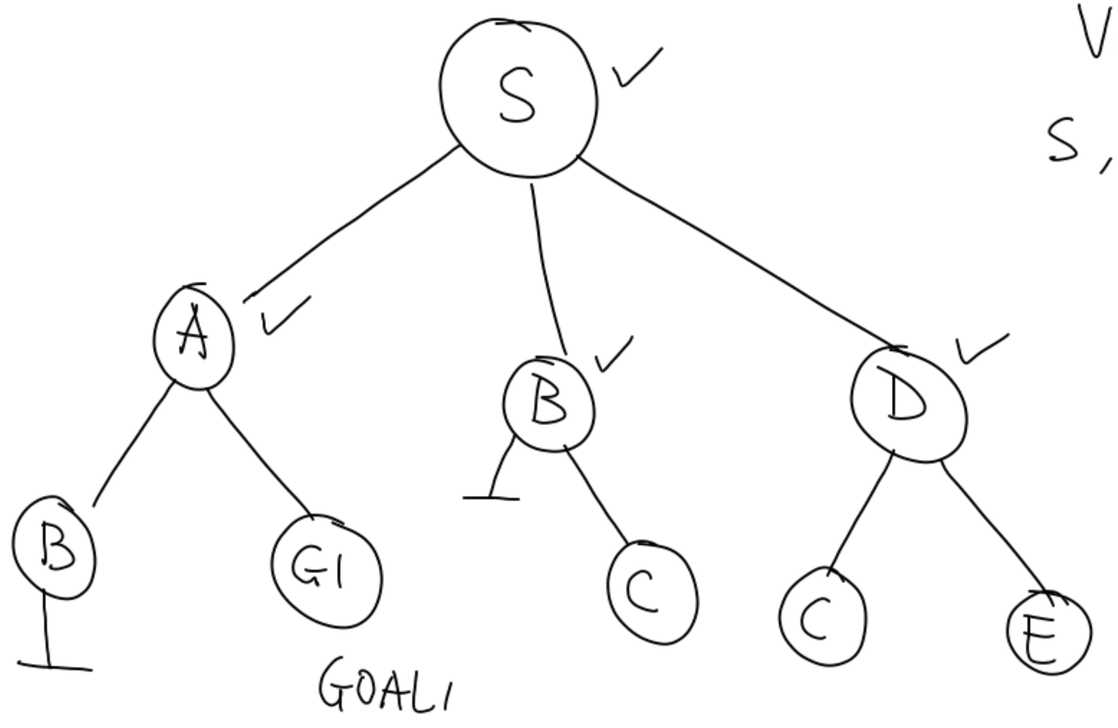


Search algorithms

- (1) Uninformed
- (2) Informed

Breadth-first search

Finds the shortest path to the goal. May not be the least cost path.

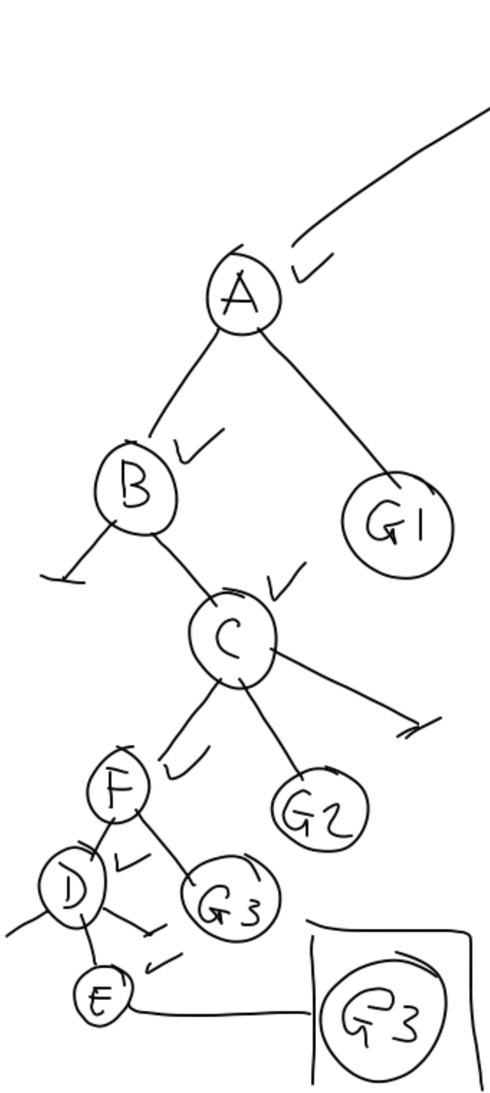


Visited

S, A, B, D

Depth-first search

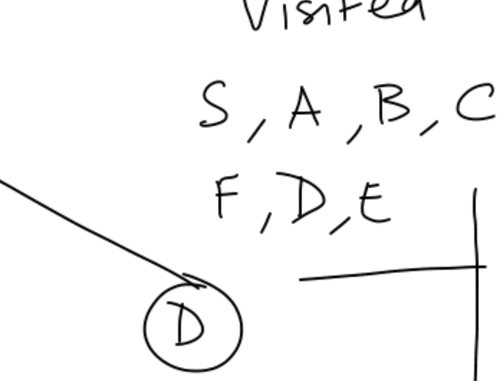
Treats the newly explored nodes as stacks.



Visited

S, A, B, C

F, D, E

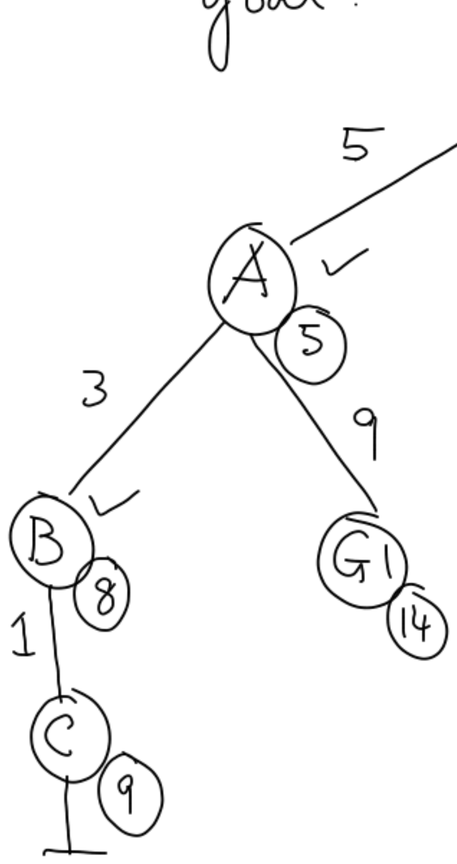


Finds the goal quickly

- Neither shortest
- Nor least cost.

Uniform Cost Search:

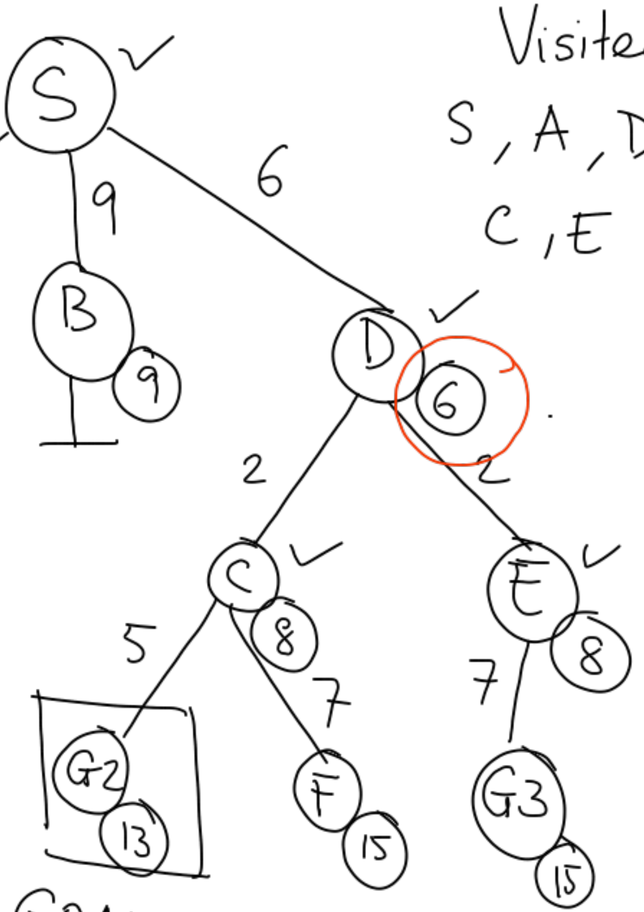
Finds the least cost path to the goal.



Visited

S, A, D, B

C, E

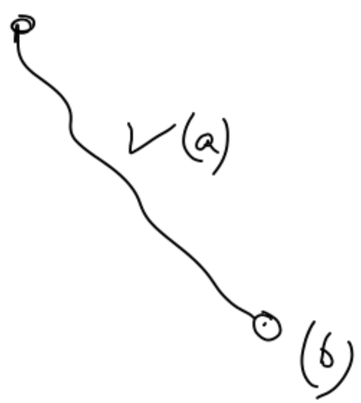


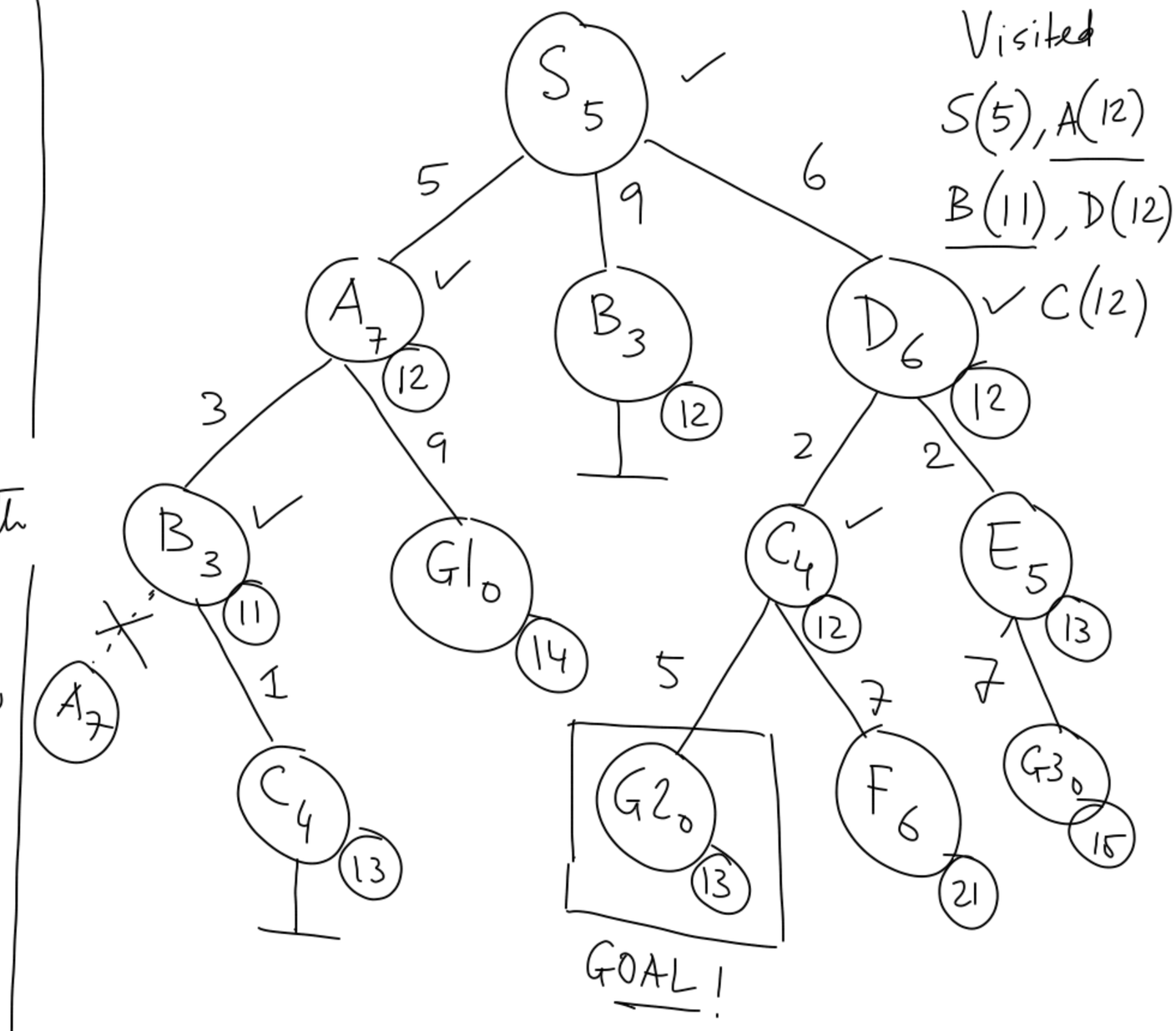
GOAL!

Uninformed searches so far

Informed Search : A* search

A* score = cost of the path (a) + estimate of the end node (b)





- Estimate is smaller than actual then always the least cost path.
- If the estimate is zero
  → Dijkstra's algorithm
- Estimates were perfect — The least cost path is quickly.
- Overestimating → suboptimal solution.