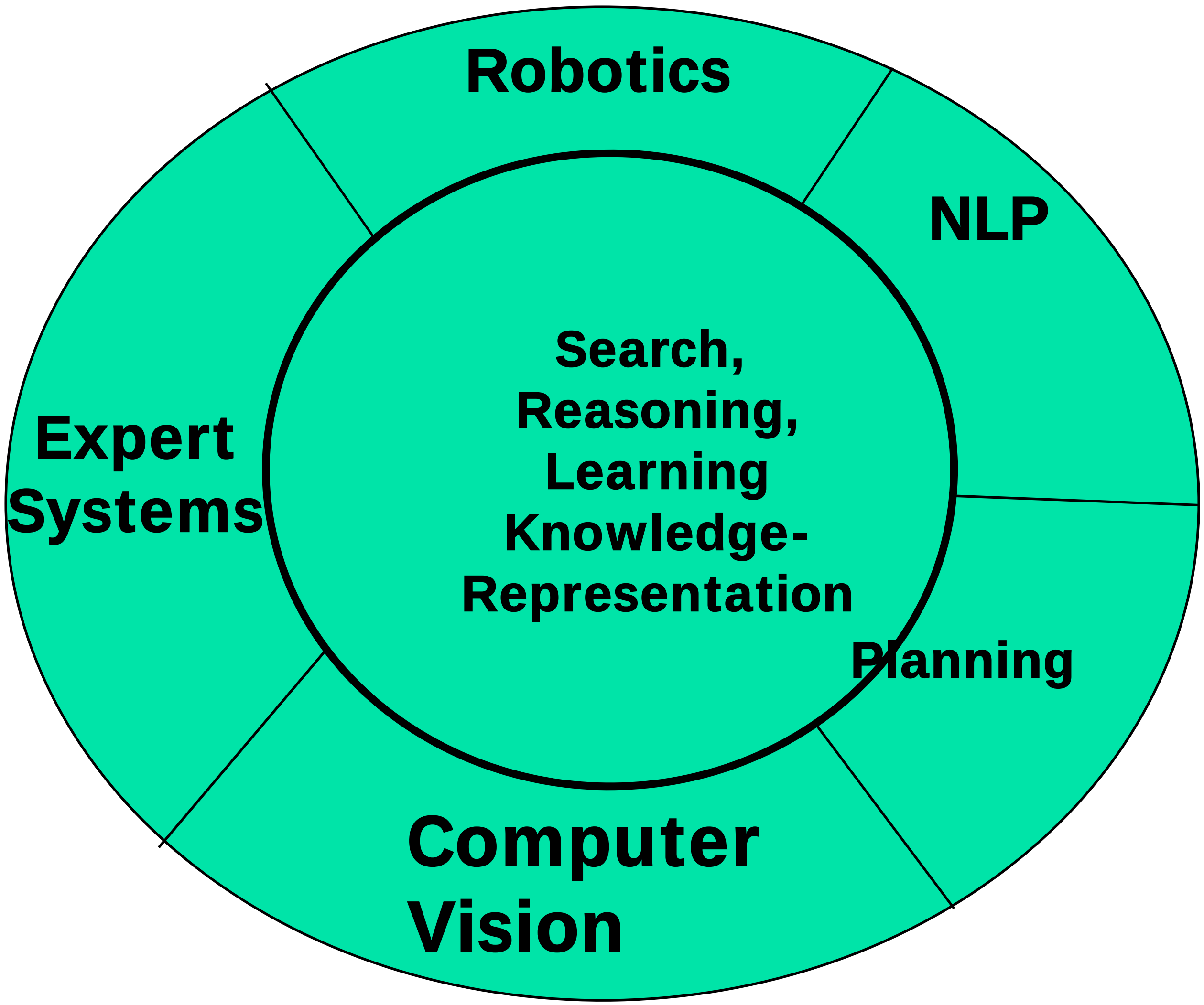
CS344: Introduction to Artificial Intelligence

Pushpak Bhattacharyya
CSE Dept.,
IIT Bombay

Lecture 13– Search

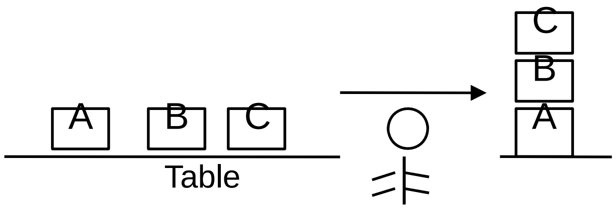
Disciplines which form the core of AI- inner circle
Fields which draw from these disciplines- outer circle.



Search: Everywhere

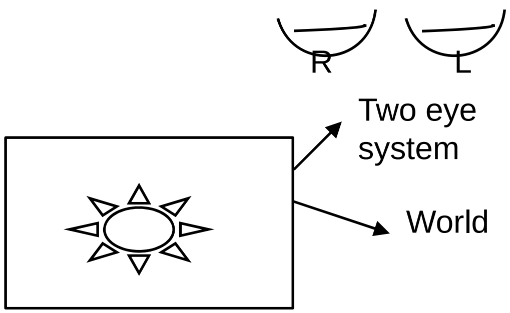
Planning

- (a) which block to *pick*, (b) which to *stack*, (c) which to *unstack*, (d) whether to *stack* a block or (e) whether to *unstack* an already stacked block. These options have to be searched in order to arrive at the right sequence of actions.



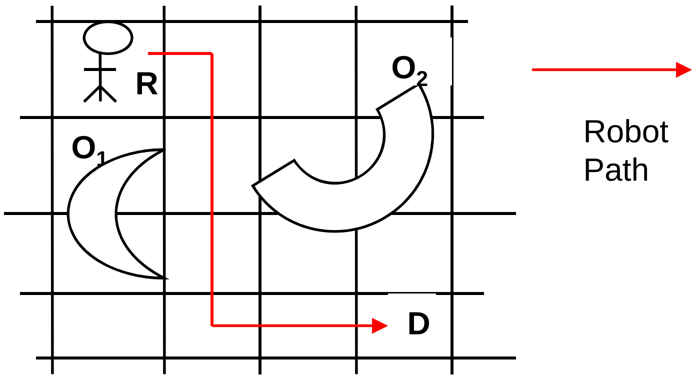
Vision

- A search needs to be carried out to find which point in the image of *L* corresponds to which point in *R*. Naively carried out, this can become an *O(n2)* process where *n* is the number of points in the retinal images.



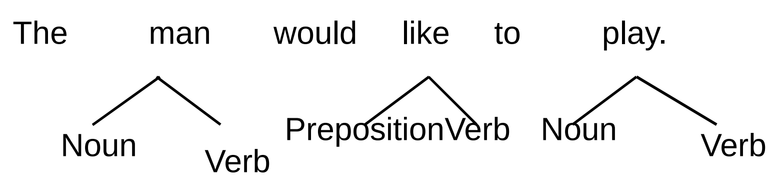
Robot Path Planning

- searching amongst the options of moving ***L***eft, ***R***ight, ***U***p or ***D***own. Additionally, each movement has an associated cost representing the relative difficulty of each movement. The search then will have to find the *optimal*, *i.e.*, the *least cost* path.



Natural Language Processing

- search among many combinations of parts of speech on the way to deciphering the meaning. This applies to every level of processing- *syntax, semantics, pragmatics* and *discourse*.



Expert Systems

Search among rules, many of which can apply to a situation:

If-conditions

the infection is primary-bacteremia
AND the site of the culture is one of the sterile sites
AND the suspected portal of entry is the gastrointestinal tract

THEN

there is suggestive evidence (0.7) that infection is bacteroid

(from MYCIN)

Search building blocks

- State Space : Graph of states (Express constraints and parameters of the problem)
- Operators : Transformations applied to the states.
- Start state : S_0 (Search starts from here)
- Goal state : $\{G\}$ - Search terminates here.
- Cost : Effort involved in using an operator.
- Optimal path : Least cost path

Examples

Problem 1 : 8 – puzzle

4	3	6
2	1	8
7		5

S

1	2	3
4	5	6
7	8	

G

Tile movement represented as the movement of the blank space.

Operators:

L : Blank moves left

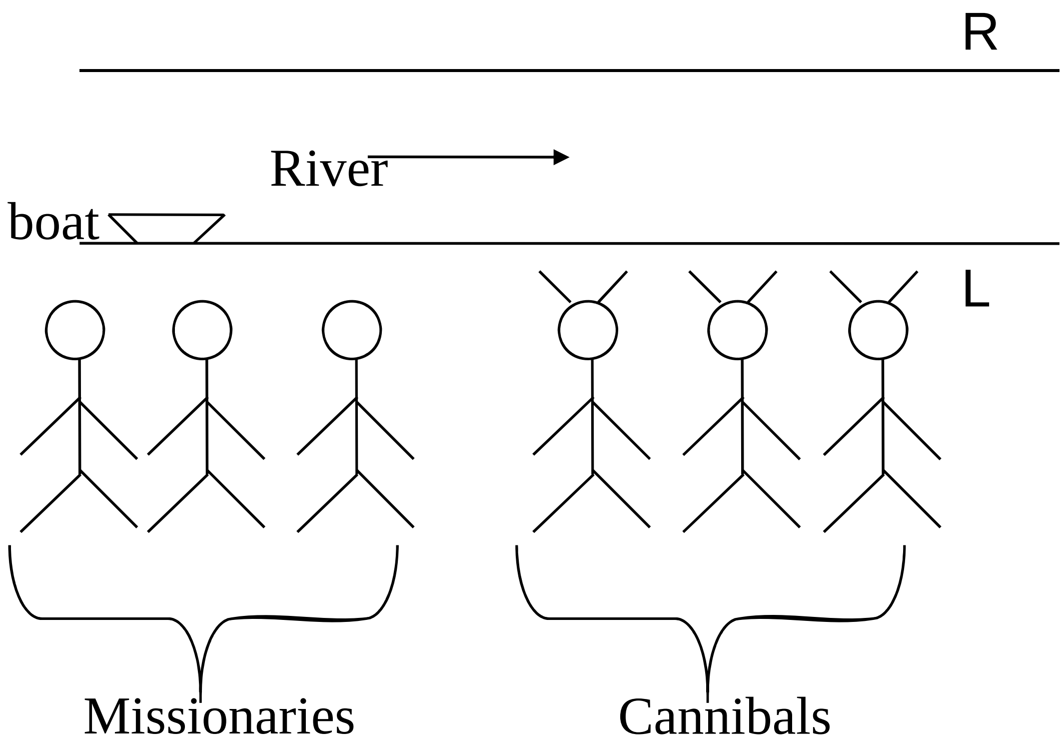
R : Blank moves right

U : Blank moves up

D : Blank moves down

$$C(L) = C(R) = C(U) = C(D) = 1$$

Problem 2: Missionaries and Cannibals



<u>Constraints</u>

- The boat can carry at most 2 people
- On no bank should the cannibals outnumber the missionaries

State : *<#M, #C, P>*

#M = Number of missionaries on bank *L*

#C = Number of cannibals on bank *L*

P = Position of the boat

S0 = <3, 3, L>

G = < 0, 0, R >

<u>Operations</u>

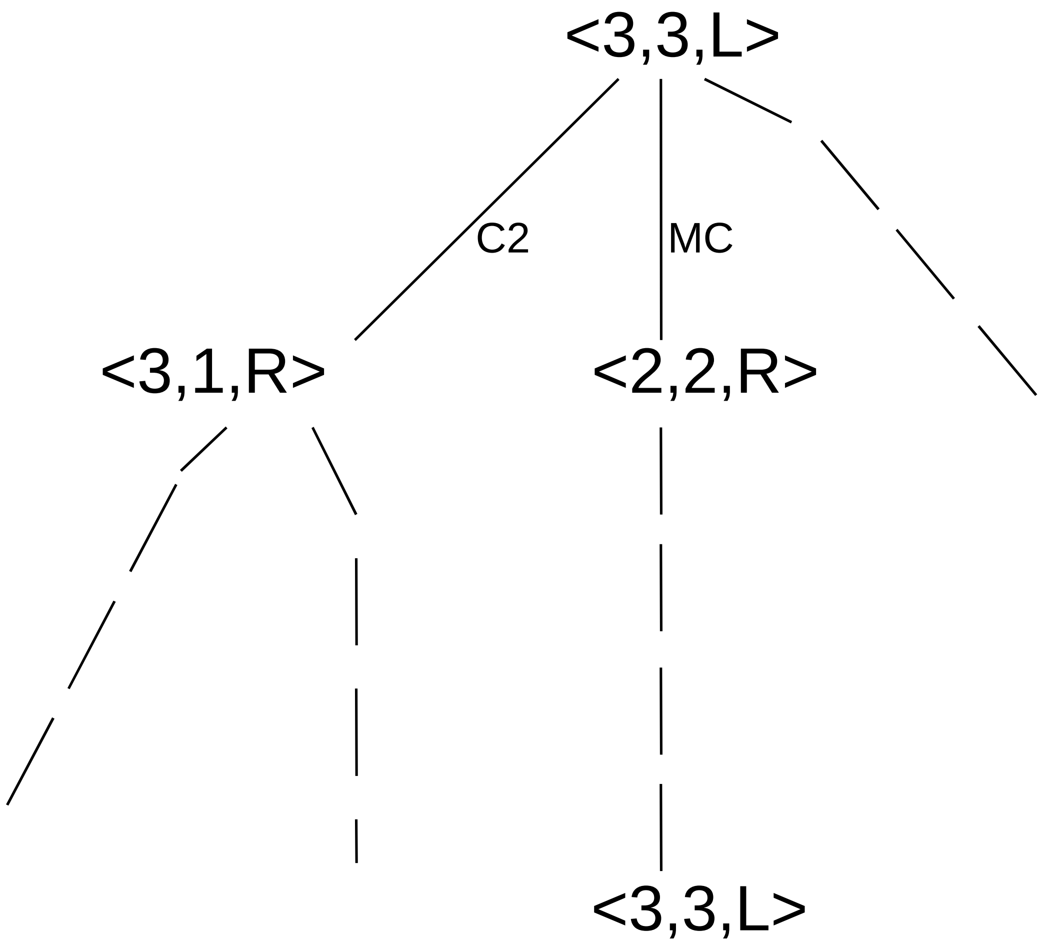
M2 = Two missionaries take boat

M1 = One missionary takes boat

C2 = Two cannibals take boat

C1 = One cannibal takes boat

MC = One missionary and one cannibal takes boat



Partial search tree

Problem 3

B	B	B	W	W	W	

G: States where no **B** is to the left of any **W**

Operators:

1) A tile jumps over another tile into a blank tile with cost 2

2) A tile translates into a blank space with cost 1

All the three problems mentioned above are to be solved using A*