Rationality/Bounded Rationality

Rationality is that do action with the best available knowledge. Bounded Rationality means that use approximation in decision making with the best of its knowledge. It was proposed by Herbert Simon in 1957.

Environment

i) Partially Observable

The Environment in which, you need to keep the track of the past. Like playing Bank game with cards.

ii) Fully Observable

The Environment in which, you don't need to keep the track of the past. Like Chess playing.

iii) Stochastic

Randomness in results, it means that you don't know what the result will be after a certain action or input. Like Luddo playing.

iv) Deterministic

Result is known. It means that you know what would be the result after a certain input/action. Like putting value 'x' in a function 'f' will give result 'y'. **f(x) = y** where f is operator.

v) Schematic/Game Theoretic

There are two things in this environment.

a) Your action must support your companion/team.
b) Your action must consider response of your component.

vi) Dynamic

While the agent is thinking, if the environment does change, then it is called dynamic environment.

vii) Static

While the agent is thinking, if the environment does not change, then it is called static environment.

viii) Continues

Where actions and perceptions are infinite, it is called Continues Environment.

ix) Discrete

Where actions and perceptions are finite, it is called Discrete Environment.

Problem solving

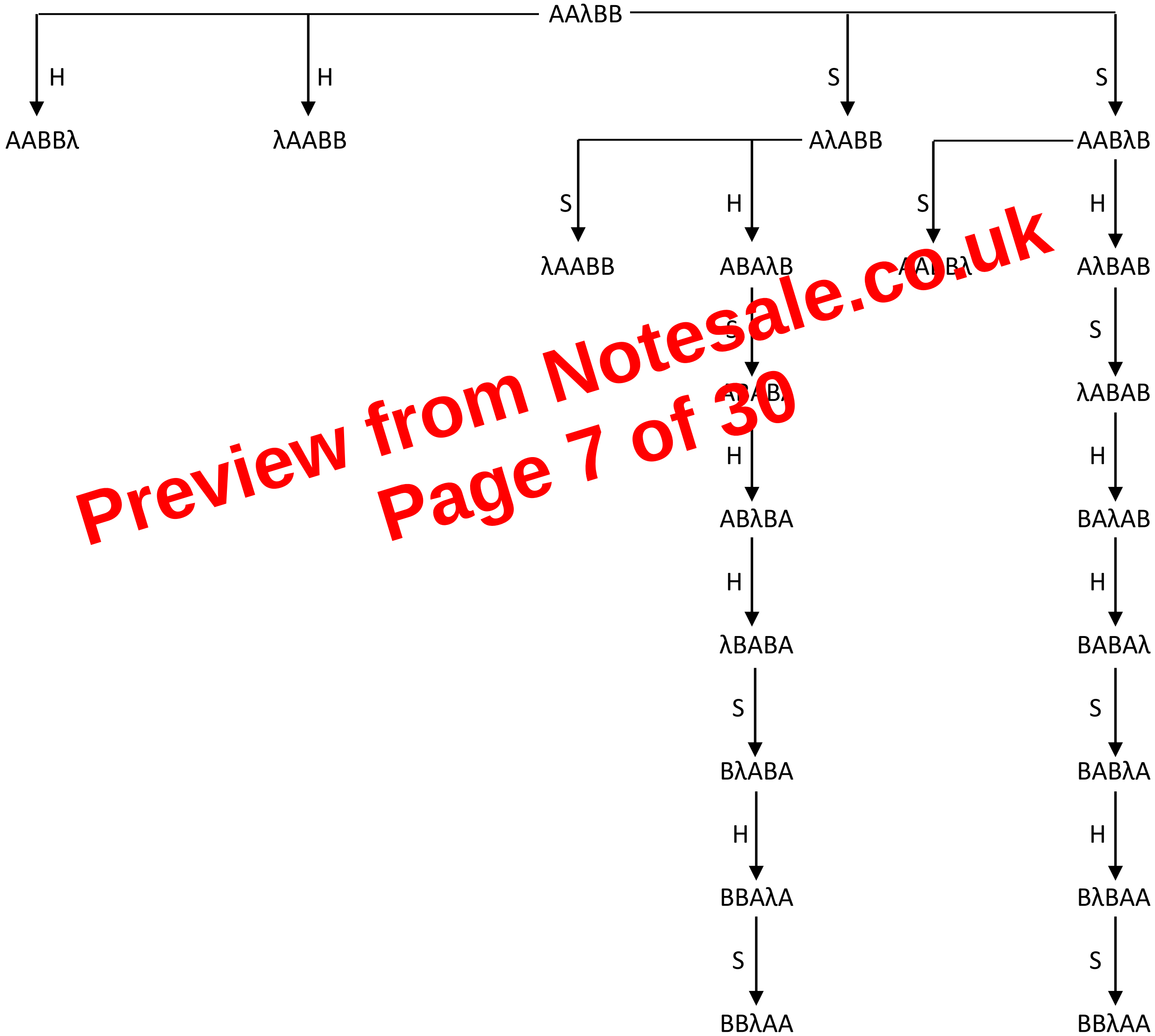
In problem solving, we have problem statement, operators and conditions.

Problem

Conversion of the string AAλBB to BBλAA: [AAλBB] ⟷ [BBλAA]

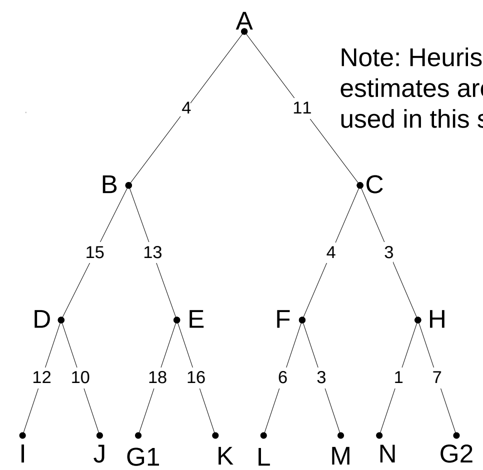
Operators

i. Slide [Xλ] ⟷ [λX]
ii. HOP [XYλ] ⟷ [λYX]
iii. All A's move right
iv. All B's move left



S => Slide, H=> HOP

Branch and Bound (Uniform Cost) Search – cont.



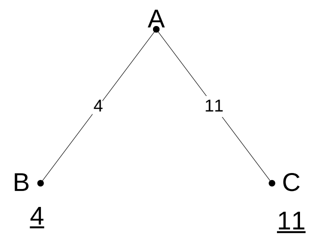
Note: Heurisitic estimates are not used in this search!

• Start with root node A.

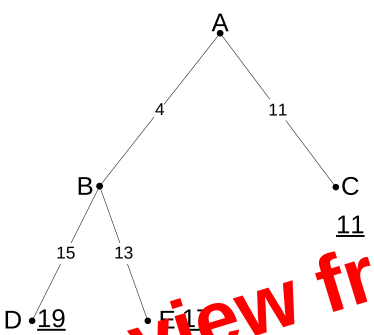
A

0

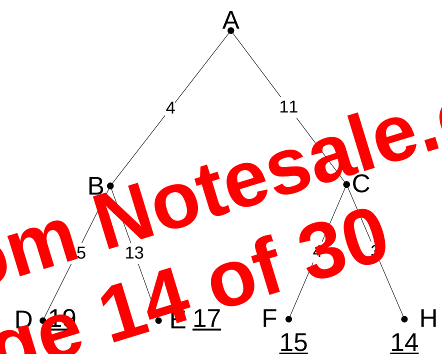
Paths from root are generated.



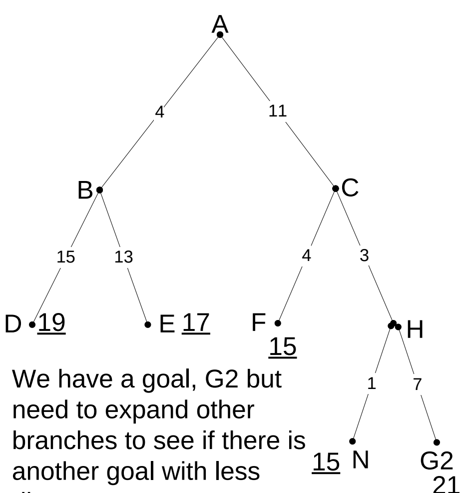
Since B has the least cost, we expand it.



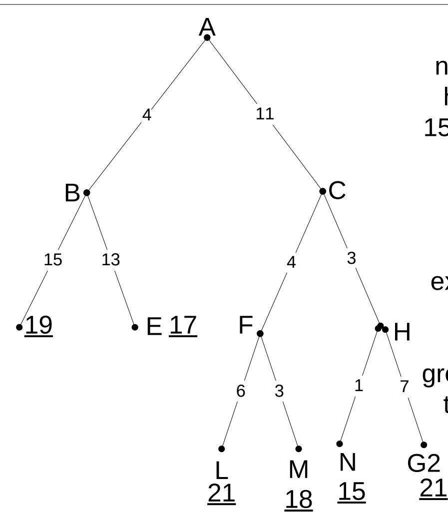
Of our 3 choices, C has the least cost so we'll expand it.



Node H has the least cost thus far, so we expand it.



We have a goal, G2 but need to expand other branches to see if there is another goal with less distance.



Note: Both nodes F and N have a cost of 15, we chose to expand the leftmost node first. We continue expanding until all remaining paths are greater than 21, the cost of G2

iii. Inheritance

Frames have different frames in it.

5. Logic

Logic is used for knowledge representation and problem solving, but it can be applied to other problems as well. Two forms of logic are following:-

i. Proposition

It is the logic of statements which can be true or false. It is also called the statement of facts. We cannot apply quantifiers on proposition.

ii. Predicate

Breaking statement into structures. It allows the use of quantifiers on predicate and can express facts about objects, their properties, and their relations with each other.

iii. Fuzzy Logic

If we are not sure about things, then it is fuzzy statement. Fuzzy logic is a version of first-order logic which allows the truth of a statement to be represented as a value between 0 and 1, rather than simply True (1) or False (0).

Reasoning

1. Inductive

Make an induction after some information about things.

2. Deductive

Deduct new information after seeing different information logically related to each other.

Example

- Man is mortal.
- Amir is man.
- ❖ Amir is mortal.

3. Abductive

If you don't get a choice of deduction, then apply Abduction (Risk).

4. Common Sense

Heuristic is a common sense.

AND Eliminate

IF P ΛQ (True)

Then P (True)

AND Intro

IF P (True)

IF Q (True)

Then P ΛQ (True)

6. Deduction Mechanism

1 2 3	A Λ B (True) A → C (True) (B Λ C)→ D (True)	To Prove D = True
4	A	AND-Elimination 1
5	B	AND-Elimination 2
6	C	Modus-Ponen 2, 4
7	B Λ C	AND-Intro 5, 6
8	D	Modus-Ponen 3, 7

7. Resolution

The resolution rule in propositional logic is a single valid inference rule that produces a new clause implied by two clauses containing complementary literals. A literal is a propositional variable or the negation of a propositional variable. Two literals are said to be complements if one is the negation of the other. Let we take the following example and make the truth table for it:

$$\frac{\begin{array}{c}\alpha \lor \beta \\ \neg\beta \lor \gamma\end{array}}{\alpha \lor \gamma}$$

α	**β**	**γ**	**¬β**	**α V β**	**¬β V γ**	**α V γ**
0	0	0	1	0	1	0
0	0	1	1	0	1	1
0	1	0	0	1	0	0
0	**1**	**1**	**0**	**1**	**1**	**1**
1	**0**	**0**	**1**	**1**	**1**	**1**