The in-class correction of last year's (I think) exam paper

Denote by † the basic AI problem of *an agent acting intelligently in its environment*.

What is a Turing machine and what does it have to do with †?

- Environment is the Tape, it needs to halt

What is the halting problem and how does it relate to †?

- Whether a turing machine on a particular input will halt or not
- Undecidable in general

What is the SAT problem and how is it related to †?

- Trying to find an assignment to the variables satisfying an expression
- Might be the task the agent is trying to complete
- Boolean expressions are a way of expressing what it's trying to complete

What is the P vs NP problem, and how does it relate to SAT?

- Feasible computation
- Cobham's theoerm
- SAT feasible if P = NP
- N allows for non determinism

A Simple way in Prolog to search is

```
search(Node) :- goal(node).
search(Node) :- arc(Node, Next), goal(next)
```

What is non-determinism? And how does it relate to search?

- There could be more than one `next`

Modify this search to do:

Bounded Depth First

depth first to a specific depth

```
bs(Node, _) :- goal(Node).
bs(Node, s(X)) :- arc(Node, Next), bs(Next, X).
```

Iterative Deepening

bounded depth fist until search succeeds

```
iterSearch(Node) :- bound(Bd), bs(Node, Bd).
bound(s(x)) :- bound(x).
```

What are the ingredients for *A Star* Search?

1. A cost on arcs
2. heuristic function on nodes indicating how close to goal node (minimum cost path to goal node)
3. Frontier search: put at head of list the node with minimal F-Value
   - $F(node) := Cost(node) + HeuristicValue(node)$

```
fs([H|_]) :- goal(H).
fs([H|T]) :-
   findall(X, arc(H, X), Children),
   addToFrontier(Children, T, New),
   fs(New).
```

What does it mean For A-Star to be admissible?

- If the search returns a solution, it returns an optimal solution (smallest cost).
- Minimal progress is made (within some epsilon), never overestimate cost.

What are the ingredients of a Contstraint Satisfaction Problem?

1. Variables
2. Domain
3. Constraints

- 3 Color problem: Variables are nodes
- Domain is $\{Red, Green, Blue\}^3$
  - every node can take 3 colors, Red, Green and Blue

  - $m = 3$
- If there's an arc between nodes, the colors must be different

What is Generate and test?

- Instantiate all of the variables before testing the constraints

```
member(X1, D1).        % --
member(X2, D2).        %   | generation
...                    %   | part
member(Xn, Dn).        % --

test(X1, Xn)           % only test after instantiating
```

Consider the knowlege base

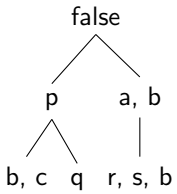
```
false :- p.
false :- a, b.
p     :- b,c.
p     :- q.
a     :- r, s.
b.
```

What are *Integrity Constraints*?

- A rule in the KB where head is false
  - Horn clause: clause with at most 1 positive literal

Suppose q, r, s were assumable. What are the conflicts? The Minimal conflicts?

Find minimal conflicts by repeated substitution



What's the complete knowlege assumption (CKA)?

- Only atoms that are true are ones we can prove. If we can't prove it we take it as false.

What does non monotonicity with respect to inference systems mean?

- $KB \vdash C \implies KB \cup \{a\} \vdash C$

What does it mean for a KB to be Consistent?

- Consistent KB $\implies \exists$ a model for the knowlege base
  - Model: Interpretation where all clauses are true