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

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

- Environment is the Tape, it needs to halt

1.2 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

1.3 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

1.4 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

2 A Simple way in Prolog to search is

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

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

- There could be more than one `next`

2.2 Modify this search to do:

2.2.1 Bounded Depth First

depth first to a specific depth

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

2.2.2 Iterative Deepening

bounded depth fist until search succeeds

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

2.3 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).
```

2.4 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.

2.5 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

2.6 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
```

3 Consider the knowlege base

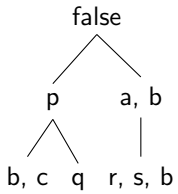
```
false :- p.
false :- a, b.
p     :- b,c.
p     :- q.
a     :- r, s.
b.
```

3.1 What are *Integrity Constraints*?

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

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

Find minimal conflicts by repeated substitution



3.3 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.

3.4 What does non monotonicity with respect to inference systems mean?

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

3.5 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