1. Consider the following proposition:

$$(A \lor B) \land (\neg A \lor \neg B) \land (\neg B \lor \neg C \lor D)$$
$$\land (C \lor E) \land (\neg E \lor \neg A) \land (\neg D \lor E) \land (\neg E \lor \neg B)$$
$$\land (E \lor \neg F \lor G) \land (\neg F \lor G \lor \neg H) \land (\neg G \lor \neg H)$$
$$\land (F \lor \neg H) \land (\neg G \lor H \lor I) \land (\neg I \lor \neg J) \land (J \lor E \lor \neg A)$$

Determine whether the given propositional formula is satisfiable. If the formula is satisfiable, provide an assignment of truth values (a truth assignment) for variables $A, B, C, D, E, F, G, H, I$, and J that satisfies the formula. If it is unsatisfiable, explain why.

2. Consider the KB for wumpus world as described in the lectures. Suppose the agent has visited squares $(1, 1)$ and $(2, 1)$ and observed

$$\text{Percepts} = \{\neg S_{2,1}, B_{2,1}, \neg S_{1,1}, \neg B_{1,1}, OK_{1,1}, OK_{2,1}\}.$$

(a) Below is an illustration of an interpretation of the wumpus world. It only specifies information regarding locations $(1, 2), (2, 2), (3, 1)$, which are the only locations affected by the percepts above. Information regarding the positions $(1, 1)$ and $(2, 1)$ is fixed by the percepts, while information regarding all other locations is ignored.

Draw all interpretations in this way (which only specifies the information regarding $(1, 2), (2, 2), (3, 1)$) that satisfy Percepts:
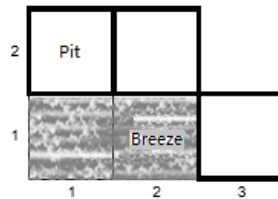
(b) Among the interpretations in (a), identify all models of KB.

(c) Consider propositions $\alpha_1 := \neg P_{1,2}$, and $\alpha_2 := \neg P_{2,2}$. Among the interpretations in (b), identify all models of α_1 and all models of α_2. From this, can you deduce the following?

$$(i).\ KB \cup \text{Percepts} \models \alpha_1$$
$$(ii).\ KB \cup \text{Percepts} \models \alpha_2$$

3. Suppose a definite clause KB contains the following propositions:

(1) $sam\_is\_happy \leftarrow night\_time \wedge no\_cloud$,

(2) $bird\_eats\_apple \leftarrow apple\_is\_red \wedge bird\_around$,

(3) $bird\_around \leftarrow no\_cloud$

(4) $apple\_is\_eaten \leftarrow bird\_eats\_apple$.

Percepts: (5) $apple\_is\_red$, (6) no_cloud.

Construct two proofs that $KB \cup \text{Percepts} \models apple\_is\_eaten$, one using forward chaining and another using SLD resolution.

4. Consider the KB that contains $a \leftarrow b$, $a \leftarrow c \wedge f$, $b \leftarrow d$, $c \leftarrow d \wedge f$, $d \leftarrow f \wedge e$, $d \leftarrow g \wedge h$, $e \leftarrow g$,

The percept is $\text{Percepts} = \{f, g\}$.

The query is ask a.

Draw the search tree for SLD resolution.