This pretest is designed to assess your background in order to plan the course most effectively. None of the questions reflect required or expected prior knowledge.

1. I will take this course for credit (circle most appropriate answer):
   - definitely
   - probably
   - undecided
   - probably not
   - definitely not

2. I plan to audit this course: yes no
3. Give an ML (either SML or O’Caml) datatype declaration to capture the following definition, where \( P \) stands for propositional variables.

Formulas

\[
A ::= P \mid A_1 \land A_2 \mid A_1 \lor A_2 \mid \bot \mid \top \mid \neg A
\]
4. Consider the following function in SML.

   \[
   \text{fun } f \ (x::l) \ k = f \ l \ (\text{fn} \ y \Rightarrow k \ (x::y)) \\
   | f \ \text{nil} \quad k = k \ \text{nil}
   \]

   (a) Give its type as inferred by SML.

   (b) Describe its action in a simple form.

   (c) Prove that it satisfies the specification from part (b).
5. For each of the following, indicate if they are theorems in intuitionistic and classical logic.

<table>
<thead>
<tr>
<th>Formula</th>
<th>Intuitionistically true?</th>
<th>Classically true?</th>
</tr>
</thead>
<tbody>
<tr>
<td>$A \lor (A \supset B)$</td>
<td></td>
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<tr>
<td>$((A \lor B) \supset C) \supset ((A \supset C) \land (B \supset C))$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\exists x. \forall y. A(x) \supset A(y)$</td>
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</tbody>
</table>

6. Explain briefly in your own words the significance of Gentzen’s cut elimination theorem (also known as the *Hauptsatz*) for first-order predicate calculus.
7. Consider the following Prolog program.

\[
p([\,], L-L).
p([X|K], [X|L]-M) :- p(K, L-M).
\]

Provide the answers of the following queries.

(a) \( ?- p([1,2,3], L-M). \)

(b) \( ?- p(K, [1,2,3]-[4,5]). \)

(c) \( ?- p(K, [1,2|L]-L). \)