1. According to an ancient Sicilian legend, there lived a barber in a remote village who shaved people, and only those people, who did not shave themselves. Could such a barber have existed?

2. Is the following argument clear (and valid)?

   All clear explanations are satisfactory. Some excuses are unsatisfactory. Therefore some excuses are not clear explanations.

3. What deduction rules of Propositional Calculus underly the following arguments:
   (a) Kangaroos live in Australia and are marsupials. Therefore kangaroos are marsupials.
   (b) This student will take a vacation scholarship next Summer. Therefore, in the coming Summer, either this student will be a beach bum or take a vacation scholarship.
   (c) If there is heavy rain and flooding, the lecture will be cancelled. The lecture has not been cancelled. Therefore there was no heavy rain and flooding.
   *(d) If I work all night I will answer all of these questions. If I answer all of these questions then I will understand the material. If I work all night I will have a headache. Therefore if I work all night I will understand the material and have a headache.
   *(e) Either it rains heavily and floods or the lecture goes ahead. It did not rain heavily or flood. Therefore the lecture goes ahead.

4. Find formal proofs for the following sequents:
   (a) \( P \vdash Q \Rightarrow (P \land Q) \)
   (b) \( P \land Q \vdash P \lor Q \)
   (c) \( P \Rightarrow Q, R \Rightarrow S \vdash (P \land R) \Rightarrow (Q \land S) \)
   *(d) \( P \Rightarrow (Q \land R) \vdash (P \Rightarrow Q) \land (P \Rightarrow R) \)
   *(e) \( \sim P \Rightarrow P \vdash P \)
   *(f) \( P \Leftrightarrow Q \vdash \sim P \Leftrightarrow \sim Q \)
   *(g) \( (P \lor Q) \Leftrightarrow P \vdash Q \Rightarrow P \)
   *(h) \( \sim P \lor Q \vdash P \Rightarrow Q \)