1. Show that in **G0ip** without weakening $A \supset (B \supset A)$ is not derivable. Show that in **G0ip** without contraction $(A \supset (A \supset B)) \supset (A \supset B)$ is not derivable.

2. Show that generalized axioms $A, \Gamma \Rightarrow \Delta, A$ are derivable in **G3cp**.

3. Using the calculus **G3cp** find conjunctive normal form for the following formulae

   (a) $(A \,\&\, B) \supset (A \supset (B \,\&\, {\sim}A))$

   (b) $(A \vee ({\sim}B \,\&\, B)) \,\&\, {\sim}(B \,\&\, {\sim}C)$

   (c) $(A \vee {\sim}{\sim}B) \supset ({\sim}B \supset A)$

4. Complete the proof of height-preserving contraction for **G3cp** (Theorem 3.2.2 on page 53 of the book) presented in the last lecture.