CL exercise for
Tutorial 5

Introduction

Unlike normal tutorials, you should treat this exercise as a test. Please complete it **without** consulting other people.

Tasks

Questions 1,2,3 are mandatory. Question 4 is optional. The usual marking scale applies.

Submit

a file called `cl-tutorial-5` with your answers (image or pdf).

Deadline

16:00 Tuesday 25 October

Reminder

Good Scholarly Practice

Please remember the good scholarly practice requirements of the University regarding work for credit.

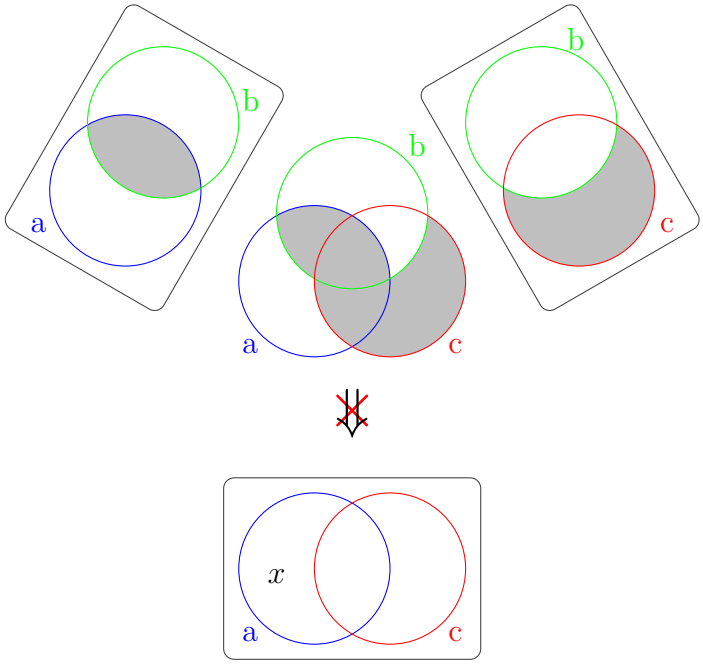
You can find guidance at the School page

https://web.inf.ed.ac.uk/infweb/admin/policies/academic-misconduct.

This also has links to the relevant University pages. Please do not publish solutions to these exercises on the internet or elsewhere, to avoid others copying your solutions.

Question 1 –mandatory–

The following is a Venn diagram demonstrating the unsoundness of a syllogism. What syllogism does it check?



Recall that the Existential Assumption says that something exists satisfying any predicate mentioned on the left side of a sequent. Explain how the Existential Assumption changes the diagram so that it shows soundness of the syllogism.

Question 2 –mandatory–

Derive

$$\frac{b \vDash \neg c \qquad c \nvDash \neg a}{a \nvDash b}$$

from *barbara*, using contraposition of sequents and rules, replacement of predicates, and double negation, as required.

Question 3 –mandatory–

Prove using the sequent calculus that

$$(\neg p \wedge \neg q) \vee (p \vee q)$$

is a tautology.

Question 4 –optional–

Logical implication $p \to q$ is defined to be $q \vee \neg p$.

Use the definition to create new sequent calculus rules $\to R$ and $\to L$ that work directly on implication formulae. That is, fill in the top lines in the rules

$$\frac{\cdots}{\Gamma, p \to q \vDash \Delta}\,(\to L) \qquad \frac{\cdots}{\Gamma \vDash p \to q, \Delta}\,(\to R)$$