Week 2 Project Report - Green Group

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1 Corrected rules

As noted in an errata to Pym's book, the $\vee L$ rule that corresponds to the natural decution rules for $\vee E$ is different than the one we (following Pym) originally gave. Also we left out the rules for $\top, \bot$, and I. The correct rules are:

$$\frac{\Gamma(\varphi) \vdash^{\mathtt{I}} \chi \quad \Gamma(\psi) \vdash^{\mathtt{I}} \chi}{\Gamma(\varphi \vee \psi) \vdash^{\mathtt{I}} \chi} \vee L^{\mathtt{I}} \qquad \frac{\Gamma(\emptyset_m) \vdash \varphi}{\Gamma(I) \vdash^{\mathtt{I}} \varphi} IL^{\mathtt{I}} \qquad \frac{}{\emptyset_m \vdash^{\mathtt{I}} I} IR^{\mathtt{I}}$$

$$\frac{}{\Gamma(\bot) \vdash^{\mathtt{I}} \varphi} \bot L^{\mathtt{I}} \qquad \frac{\Gamma(\emptyset_a) \vdash^{\mathtt{I}} \varphi}{\Gamma(\top) \vdash^{\mathtt{I}} \varphi} \top L^{\mathtt{I}} \qquad \frac{}{\emptyset_a \vdash^{\mathtt{I}} \top} \top R^{\mathtt{I}}$$

This $\vee L^{\mathtt{I}}$ rule is probably better suited for forward proof search, as it keeps the database smaller (it applies in fewer cases).

2 Focusing for backward BI sequent calculus

We began to formulate focusing for **BI** and ran into a number of issues. The primary issue is that the tree structure of the context introduces a number of possible formulations of focusing. We may have to implement some sort of mutually recursive interleaving of intuitionistic and linear focusing. However, we may have a way not to do that.

The primary issue is the LL rule which as stated for intuitionistic logic (using slightly different syntax because ; and , have different meanings for us) is

$$\frac{\Delta; L \mid \Omega \Longrightarrow . \mid R}{\Delta \mid \Omega; L \Longrightarrow . \mid R}\ L\mathrm{L}$$

We have proposed the following rule:

$$\frac{\Delta; L \mid \Omega \Longrightarrow . \mid R \quad \vdash L\ \mathbf{sync}}{\Delta \mid \Omega; L \Longrightarrow . \mid R}\ L\mathrm{L}$$

Where L **sync** is a judgement that holds iff a context connot be further broken down by asynchronous rules. Here we think of $\Omega; L$ as the bunch **;**$(\Omega \cup \{L\})$ and only move L as a full top-level tree when all of its leaves have been fully broken down by synchronous rules. It is our conjecture that, what corresponds to chosing a formula to focus on in the intuitionistic case is picking a top-level tree (i.e. rooted in the top-level additive context) to focus on and then to perform focusing within that tree. In this way there are fewer permutations of formula order to work on since we dont consider interleavings between formulas from different top level trees. We are not sure that this will turn out to be correct, but it seems like it might be.

3 Code Status

We have mostly implemented focusing for intuitionistic propositional logic, which we are now going to give up to focus just on **BI**. We also have the components to the propositional inverse **BI** prover done and checked into CVS, there are just a few API issues to smooth out to put them together.