

**Homework 2**

1. In any category with binary products, show that:

$$A \times (B \times C) \cong (A \times B) \times C.$$

(Hint: define the notion of a “ternary product,” and then use the fact that they are unique up to isomorphism.)

2. In any category with binary products and coproducts, show that:

$$C^{A+B} \cong C^A \times C^B.$$

(There’s no trick for this one – you’ll have to crank it out.)

3. Show that the category of types of the  $\lambda$ -calculus with sum types has binary coproducts.
4. Show that the category of groups is not cartesian closed, but that the category of groupoids is. (A *groupoid* is a category in which all arrows are isos.)
5. Prove the three laws of positive intuitionistic propositional calculus from the laws for a CCC.