Category Theory – Exercise Sheet 3

September 27, 2013

The deadline is 6pm on Thursday the 3rd of October. You can either email your answers to `r.furber` at `cs.ru.nl` (do not forget the attachment) or put them in Robert Furber's postbox on the north side of the second floor of the Huygensgebouw. It is inside a white cabinet with its back to the stairs, opposite the photocopier. Please fasten the sheets of paper together with a staple or paperclip.

For each question, the number of marks available is indicated in round brackets. The total number is 50.

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Let $\mathbf{C}$ be a category with products and terminal object 1. Take objects $A, B, C \in \mathbf{C}$ and $f, g \in \mathrm{Arr}(\mathbf{C})$ arrows in $\mathbf{C}$. Prove the following:

(a) $A \times B \cong B \times A$ (6pt)

(b) $1 \times A \cong A \cong A \times 1$ (9pt)

(c) If f and g are monic, so is $f \times g$. (6pt)

(d) If f is monic, so is $\langle f, g \rangle$. (4pt)

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Recall **JSL**, the category of join-semilattices from exercise 6 last week. (17pt)
Show, giving all details, that **JSL** has finite products.

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The category **Rel** has sets as objects and maps $X \to Y$ are relations $R \subseteq X \times Y$. Show, giving all details, that **Rel** has finite coproducts. Show that these are also products. (8pt)