10. Show that there is no term P_2 such that $P_2(xy) =_\lambda y$.

11. Show that given terms A_1, A_2, A_3 there exists a term H such that the scheme of primitive recursion of footnote 5.10 in Reflection and its Use is valid.

$$\begin{aligned} H(F_L x) &= A_1 x(Hx) \\ H(F_p xy) &= A_2 xy(Hx)(Hy) \\ H(F_! x) &= A_3 x(Hx) \end{aligned}$$

12. Construct terms P_1 and P_2 such that for all terms M, N

$$P_1 \ulcorner MN \urcorner = M \;\&\; P_2 \ulcorner MN \urcorner = N.$$

13. Show that there exists a term **Num** such that for all terms M
Num $\ulcorner M \urcorner = \ulcorner\ulcorner M \urcorner\urcorner$.

14. Prove $\forall M \exists N [N$ in β-nf and $N\mathbf{I} \twoheadrightarrow_\beta M]$.

15. Let $A \equiv \lambda axz.z(aax)$ and $M \equiv AAx$. Pove that M does not have a normal form.

16. $M \in \Lambda^\tau$ is in long $\beta\eta$-normal form iff

$$M \equiv \lambda x_1 \ldots x_n.xM_1 \ldots M_m,$$

where $xM_1 \ldots M_m$ has type 0 and each M_i is in long $\beta\eta$-normal form.

FAKT Each $M \in \Lambda^\tau$ is $\beta\eta$-equal to a (unique) long $\beta\eta$-normal form.

Let x be a variable of type $(0 \to 0) \to ((0 \to 0) \to 0) \to 0$. Find the long $\beta\eta$-normal form of x.