G6021: Comparative Programming

Some more exercises on the λ-calculus

1. Insert all the missing parentheses and λ's into the following abbreviated λ-terms, where $I = \lambda x.x$.

   - $\lambda xy.x$
   - $\lambda xy.xyy$
   - $\lambda xyz.xz(yz)$
   - $\lambda xyz.x(yz)$
   - $\lambda xyz.xzy$
   - $\lambda xy.x(xy)$
   - $\lambda x.xI$
   - $\lambda x.xII$
   - $\lambda x.xIII$
   - $(\lambda xy.y(xxy))(\lambda xy.y(xxy))$
   - $\lambda f.(\lambda x.f(xx))(\lambda x.f(xx))$

2. Let $I = \lambda x.x$, $B = \lambda xyz.x(yz)$, $C = \lambda xyz.xzy$, $T = \lambda xy.x(xy)$ and $Y = (\lambda xy.y(xxy))(\lambda xy.y(xxy))$.

   Reduce the following terms to normal form, if they have one. You do not need to draw a reduction graph.

   - CI
   - $C(\lambda x.xII)I$
   - Y
   - $TBCI$
   - TI
   - TT
   - TTT (Just joking - this takes 42 beta reductions...)