HW8

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1. Eager:
   $((\lambda x.\lambda z.x\ z)(\lambda w.\lambda x.w\ x))((\lambda x.x\ x)(\lambda y.y))$
   $\Rightarrow ((\lambda z.z)(\lambda w.\lambda x.w\ x))((\lambda x.x\ x)(\lambda y.y))$
   $\Rightarrow ((\lambda z.z)(\lambda x.x))((\lambda x.x\ x)(\lambda y.y))$
   $\Rightarrow (\lambda x.x)((\lambda x.x\ x)(\lambda y.y))$
   $\Rightarrow (\lambda x.x)(\lambda y.y)$
   $\Rightarrow (\lambda y.y)(\lambda y.y)$
   $\Rightarrow \lambda y.y$

2. Lazy:
   $((\lambda x.\lambda z.x\ z)(\lambda w.\lambda x.w\ x))((\lambda x.x\ x)(\lambda y.y))$
   $\Rightarrow (\lambda z.(\lambda w.\lambda x.w\ x)\ z))((\lambda x.x\ x)(\lambda y.y))$
   $\Rightarrow (\lambda w.\lambda x.w\ x)\ ((\lambda x.x\ x)(\lambda y.y))$
   $\Rightarrow (\lambda x.((\lambda x.x\ x)(\lambda y.y))\ x)$
   $\Rightarrow (\lambda x.((\lambda y.y)(\lambda y.y))\ x)$
   $\Rightarrow (\lambda x.(\lambda y.y)\ x)$
   $\Rightarrow \lambda x.x$

3. Unrestricted:
   $((\lambda x.\lambda z.x\ z)(\lambda w.\lambda x.w\ x))((\lambda x.x\ x)(\lambda y.y))$
   $\rightarrow_\alpha ((\lambda w.\lambda z.w\ z)(\lambda w.\lambda x.w\ x))((\lambda x.x\ x)(\lambda y.y))$
   $\rightarrow_\alpha ((\lambda w.\lambda x.w\ x)(\lambda w.\lambda x.w\ x))((\lambda x.x\ x)(\lambda y.y))$
   $\rightarrow_\beta (\lambda z.(\lambda w.\lambda x.w\ x)\ z)((\lambda x.x\ x)(\lambda y.y))$
   $\rightarrow_\beta (\lambda z.(\lambda w.\lambda x.w\ x)\ z)((\lambda y.y)(\lambda y.y))$
   $\rightarrow_\beta (\lambda z.(\lambda w.\lambda x.w\ x)\ z)(\lambda y.y)$

$\rightarrow_\beta (\lambda w.\lambda x.w\ x)\ (\lambda y.y)$
$\rightarrow_\beta (\lambda x.(\lambda y.y)\ x)$
$\rightarrow_\beta \lambda x.x$