

## 1 Normal Form

$$((\lambda a.(\lambda b.b\ b)\ (\lambda b.b\ b))\ b)\ ((\lambda c.(c\ b))\ (\lambda a.a)) \rightarrow_{\beta}$$

$$((\lambda b.b\ b)\ (\lambda b.b\ b))\ ((\lambda c.(c\ b))\ (\lambda a.a)) \rightarrow_{\beta}$$

$$((\lambda b.b\ b)\ (\lambda b.b\ b))\ ((\lambda c.(c\ b))\ (\lambda a.a)) \rightarrow_{\beta}$$

$$((\lambda b.b\ b)\ (\lambda b.b\ b))\ ((\lambda a.a)\ b) \rightarrow_{\beta}$$

$$((\lambda b.b\ b)\ (\lambda b.b\ b))\ b \rightarrow_{\beta}$$

$$((\lambda b.b\ b)\ (\lambda b.b\ b))\ b \rightarrow_{\beta}$$

...

## 2 S S K

$$\mathbf{I} \equiv \lambda x.x$$

$$K \equiv \lambda x\ y.x$$

$$S \equiv \lambda x\ y\ z.x\ z\ (y\ z)$$

$$(\lambda x\ y\ z.x\ z\ (y\ z))\ (\lambda a\ b.a)\ (\lambda a\ b.a) \rightarrow_{\beta}$$

$$(\lambda y\ z.(\lambda a\ b.a)\ z\ (y\ z))\ (\lambda a\ b.a) \rightarrow_{\beta}$$

$$\lambda z.(\lambda a\ b.a)\ z\ ((\lambda a\ b.a)\ z) \rightarrow_{\beta}$$

$$\lambda z.(\lambda b.z)\ ((\lambda a\ b.a)\ z) \rightarrow_{\beta}$$

$$\lambda z.z$$