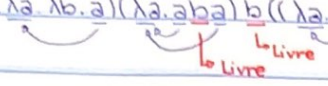


LC01-12

Fernanda Oliveira Carneiro de Albuquerque

Questão 1:

a) $(\lambda a. \lambda b. a)(\lambda a. a b a) b ((\lambda a. a a a)(\lambda a. a a))$



$\rightarrow (\lambda c. \lambda d. c)(\lambda f. f b f) b ((\lambda g. g g g)(\lambda h. h h))$

caminho 1: $(\lambda g. g g g)(\lambda h. h h)$

$\xrightarrow{\beta} (\lambda c. \lambda d. c)(\lambda f. f b f) b ((\lambda h. h h) \xrightarrow{a} (\lambda h. h h)(\lambda h. h h))$

$\xrightarrow{\beta} (\lambda c. \lambda d. c)(\lambda f. f b f) b ((\lambda h. h h)(\lambda h. h h)(\lambda h. h h))$

∞

caminho 2: $(\lambda c. \lambda d. c)(\lambda f. f b f)$

$\xrightarrow{\beta} (\lambda d(\lambda f. f b f)) b ((\lambda g. g g g) \xrightarrow{a} (\lambda h. h h))$

$\xrightarrow{\beta} (\lambda d(\lambda f. f b f)) b ((\lambda h. h h)(\lambda h. h h)(\lambda h. h h))$

∞

$b)(\lambda a. \lambda b. b)((\lambda b. \lambda a. ab) b)((\lambda a. aba)(\lambda a. aa))$

$\rightarrow (\lambda c. \lambda d. d)((\lambda e. \lambda f. fe) b)((\lambda g. gbg)(\lambda h. hh))$

• caminho 1: $\frac{(\lambda e. \lambda f. fe) b}{M} \frac{b}{a}$

$\xrightarrow{\beta} (\lambda c. \lambda d. d)(\lambda f. fb)((\lambda g. gbg)(\lambda h. hh))$

$\xrightarrow{\beta} (\lambda c. \lambda d. d)(\lambda f. fb)(\frac{(\lambda h. hh) b}{M} \frac{b}{a} (\lambda h. hh))$

$\xrightarrow{\beta} (\lambda c. \lambda d. d)(\lambda f. fb)(\frac{bb(\lambda h. hh)}{M} \frac{b}{a})$

$\xrightarrow{\beta} (\lambda c. \frac{\lambda d. d}{M} \frac{((bb(\lambda h. hh))b)}{a})$

$\xrightarrow{\beta} \lambda d. d$

• caminho 2: $\frac{(\lambda g. gbg)(\lambda h. hh)}{M} \frac{b}{a}$

$\xrightarrow{\beta} (\lambda c. \lambda d. d)((\lambda e. \lambda f. fe) b)(\frac{(\lambda h. hh) b}{M} \frac{b}{a} (\lambda h. hh))$

$\xrightarrow{\beta} (\lambda c. \lambda d. d)((\lambda e. \lambda f. fe) \frac{b}{M} \frac{b}{a})(bb(\lambda h. hh))$

$\xrightarrow{\beta} (\lambda c. \lambda d. d)(\lambda f. fb)(\frac{bb(\lambda h. hh)}{M} \frac{b}{a})$

$\xrightarrow{\beta} (\lambda c. \frac{\lambda d. d}{M} \frac{((bb(\lambda h. hh))b)}{a})$

$\rightarrow \lambda d. d$

$$c) (\lambda a. \lambda a. b) ((\lambda b. \lambda a. ab) b) ((\lambda a. aba) (\lambda a. aa))$$

\downarrow Livre \downarrow Livre \downarrow Livre

$$\alpha \triangleright (\lambda c. \lambda d. b) ((\lambda e. \lambda f. ef) b) ((\lambda g. gbg) (\lambda h. hh))$$

• caminho 1: $(\lambda e. \lambda f. ef) b$

$\frac{m}{a}$

$$\beta \triangleright (\lambda c. \lambda d. b) (\lambda f. bf) ((\lambda g. gbg) (\lambda h. hh))$$

$\frac{m}{a}$

$$\beta \triangleright (\lambda c. \lambda d. b) (\lambda f. bf) ((\lambda h. hh) b (\lambda h. hh))$$

$\frac{m}{a}$

$$\beta \triangleright (\lambda c. \lambda d. b) (\lambda f. bf) (bb (\lambda h. hh))$$

$\frac{m}{a}$

$$\beta \triangleright (\lambda d. b) (bb (\lambda h. hh))$$

$\frac{m}{a}$

$$\beta \triangleright b$$

• caminho 2: $(\lambda g. gbg) (\lambda h. hh)$

$\frac{m}{a}$

$$\beta \triangleright (\lambda c. \lambda d. b) ((\lambda e. \lambda f. ef) b) ((\lambda h. hh) b (\lambda h. hh))$$

$\frac{m}{a}$

$$\beta \triangleright (\lambda c. \lambda d. b) ((\lambda e. \lambda f. ef) b) (bb (\lambda h. hh))$$

$\frac{m}{a}$

$$\beta \triangleright (\lambda c. \lambda d. b) (\lambda f. bf) (bb (\lambda h. hh))$$

$\frac{m}{a}$

$$\beta \triangleright (\lambda d. b) (bb (\lambda h. hh))$$

$\frac{m}{a}$

$$\beta \triangleright b$$

$$d)(\lambda a. \lambda b. b)(\lambda b. (\lambda a. ab) b)((\lambda a. aba)(\lambda a. aa))$$

$$\xrightarrow{\alpha} (\lambda c. \lambda d. d)(\lambda e. (\lambda f. fe) e)((\lambda g. gbg)(\lambda h. hh))$$

• caminho 1: $(\lambda e. (\lambda f. fe) e)$
 $\frac{m}{a}$

$$\xrightarrow{\beta} (\lambda c. \lambda d. d)(\lambda e. ee)((\lambda g. gbg)(\lambda h. hh))$$

$$\xrightarrow{\beta} (\lambda c. \lambda d. d)(\lambda e. ee)((\lambda h. hh) b (\lambda h. hh))$$

$$\xrightarrow{\beta} (\lambda c. \lambda d. d)(\lambda e. ee)(bb(\lambda h. hh))$$

$$\xrightarrow{\beta} (\lambda d. d)(bb(\lambda h. hh))$$

$$\xrightarrow{\beta} bb(\lambda h. hh)$$

• caminho 2: $(\lambda g. gbg)(\lambda h. hh)$
 $\frac{m}{a}$

$$\xrightarrow{\beta} (\lambda c. \lambda d. d)(\lambda e. (\lambda f. fe) e)((\lambda h. hh) b (\lambda h. hh))$$

$$\xrightarrow{\beta} (\lambda c. \lambda d. d)(\lambda e. (\lambda f. fe) e)(bb(\lambda h. hh))$$

$$\xrightarrow{\beta} (\lambda c. \lambda d. d)(\lambda e. ee)(bb(\lambda h. hh))$$

$$\xrightarrow{\beta} (\lambda d. d)(bb(\lambda h. hh))$$

$$\xrightarrow{\beta} bb(\lambda h. hh)$$