Appendix B

Situation Semantics Calculations

B.1 A Conditional Donkey Sentence

There follows a calculation establishing the truth conditions for a donkey sentence containing a quantificational adverb and an *if*-clause. See section 2.3.1.

$$\llbracket[[\text{always [if [a man] [}\lambda_6\text{ [[a donkey] [}\lambda_2\text{ [t}_6\text{ owns t}_2\text{]]]]]]}$$
$$\text{[[he man] beats [it donkey]]]]}\rrbracket^{\emptyset}$$

$$= \llbracket\text{always}\rrbracket^{\emptyset}(\llbracket\text{[if [a man] [}\lambda_6\text{ [[a donkey] [}\lambda_2\text{ [t}_6\text{ owns t}_2\text{]]]]]]}\rrbracket^{\emptyset})$$
$$(\llbracket\text{[[he man] beats [it donkey]]}\rrbracket^{\emptyset}) \qquad \text{(by FA)}$$

$$= \llbracket\text{always}\rrbracket^{\emptyset}(\llbracket\text{[if [a man] [}\lambda_6\text{ [[a donkey] [}\lambda_2\text{ [t}_6\text{ owns t}_2\text{]]]]]]}\rrbracket^{\emptyset})$$
$$(\llbracket\text{beats}\rrbracket^{\emptyset}\ (\llbracket\text{it}\rrbracket^{\emptyset}(\llbracket\text{donkey}\rrbracket^{\emptyset}))(\llbracket\text{he}\rrbracket^{\emptyset}\ (\llbracket\text{man}\rrbracket^{\emptyset}))) \qquad \text{(by FA)}$$

$$= \llbracket\text{always}\rrbracket^{\emptyset}(\llbracket\text{[if [a man] [}\lambda_6\text{ [[a donkey] [}\lambda_2\text{ [t}_6\text{ owns t}_2\text{]]]]]]}\rrbracket^{\emptyset})$$
$$([\lambda u_1.\, \lambda u_2.\, \lambda s_8.\, u_2(s_8) \text{ beats in } s_8\ u_1(s_8)]$$
$$([\lambda f_{\langle\langle s,e\rangle,\langle s,t\rangle\rangle}.\, \lambda s_7 : \exists! x\, f(\lambda s_9.x)(s_7) = 1.\, \iota x\, f(\lambda s_9.x)(s_7) = 1]$$
$$(\lambda u_3.\, \lambda s_6.\, u_3(s_6) \text{ is a donkey in } s_6))$$
$$([\lambda f_{\langle\langle s,e\rangle,\langle s,t\rangle\rangle}.\, \lambda s_1 : \exists! x\, f(\lambda s_9.x)(s_1) = 1.\, \iota x\, f(\lambda s_9.x)(s_1) = 1]$$
$$(\lambda u_4.\, \lambda s_3.u_4(s_3) \text{ is man in } s_3))) \qquad \text{(by Lex)}$$

$$= \llbracket\text{always}\rrbracket^{\emptyset}(\llbracket\text{[if [a man] [}\lambda_6\text{ [[a donkey] [}\lambda_2\text{ [t}_6\text{ owns t}_2\text{]]]]]]}\rrbracket^{\emptyset})$$
$$([\lambda u_1.\, \lambda u_2.\, \lambda s_8.\, u_2(s_8) \text{ beats in } s_8\ u_1(s_8)]$$
$$(\lambda s_7 : \exists! x\ x \text{ is a donkey in } s_7.\, \iota x\ x \text{ is a donkey in } s_7)$$
$$(\lambda s_1 : \exists! x\ x \text{ is a man in } s_1.\, \iota x\ x \text{ is a man in } s_1)) \qquad \text{(by } \lambda\text{C)}$$

$$= \llbracket\text{always}\rrbracket^{\emptyset}(\llbracket\text{[if [a man] [}\lambda_6\text{ [[a donkey] [}\lambda_2\text{ [t}_6\text{ owns t}_2\text{]]]]]]}\rrbracket^{\emptyset})$$
$$(\lambda s_8.\, \iota x\ x \text{ is a man in } s_8 \text{ beats in } s_8\ \iota x\ x \text{ is a donkey in } s_8) \qquad \text{(by } \lambda\text{C)}$$

$$= \llbracket\text{always}\rrbracket^{\emptyset}(\llbracket\text{if}\rrbracket^{\emptyset}(\llbracket\text{a}\rrbracket^{\emptyset}\ (\llbracket\text{man}\rrbracket^{\emptyset})(\llbracket[\lambda_6\text{ [[a donkey] [}\lambda_2\text{ [t}_6\text{ owns t}_2\text{]]]]]}\rrbracket^{\emptyset})))$$
$$(\lambda s_8.\, \iota x\ x \text{ is a man in } s_8 \text{ beats in } s_8\ \iota x\ x \text{ is a donkey in } s_8) \qquad \text{(by FA)}$$

$$= \llbracket\text{always}\rrbracket^{\emptyset}(\llbracket\text{if}\rrbracket^{\emptyset}(\llbracket\text{a}\rrbracket^{\emptyset}(\llbracket\text{man}\rrbracket^{\emptyset})\ (\lambda u_6.\, \llbracket\text{[[a donkey] [}\lambda_2\text{ [t}_6\text{ owns}$$
$$\text{t}_2\text{]]]}\rrbracket^{[6\to u_6]}))) \ (\lambda s_8.\, \iota x\ x \text{ is a man in } s_8 \text{ beats in } s_8\ \iota x\ x \text{ is a donkey in } s_8)$$
$$\text{(by PA)}$$

$= [\![\text{always}]\!]^{\emptyset}([\![\text{if}]\!]^{\emptyset}([\![\text{a}]\!]^{\emptyset}([\![\text{man}]\!]^{\emptyset})$
$(\lambda u_6.\, [\![\text{a}]\!]^{[6\to u_6]}([\![\text{donkey}]\!]^{[6\to u_6]})([\![[\lambda_2\ [\text{t}_6\text{ owns t}_2]]]\!]^{[6\to u_6]}))))$
$(\lambda s_8.\, \iota x\ x \text{ is a man in } s_8 \text{ beats in } s_8\ \iota x\ x \text{ is a donkey in } s_8)$ (by FA)

$= [\![\text{always}]\!]^{\emptyset}([\![\text{if}]\!]^{\emptyset}([\![\text{a}]\!]^{\emptyset}([\![\text{man}]\!]^{\emptyset})$
$(\lambda u_6.\, [\![\text{a}]\!]^{[6\to u_6]}([\![\text{donkey}]\!]^{[6\to u_6]})(\lambda u_2.\, [\![[\text{t}_6\text{ owns t}_2]]\!]^{\begin{bmatrix}6\to u_6\\2\to u_2\end{bmatrix}}))))$
$(\lambda s_8.\, \iota x\ x \text{ is a man in } s_8 \text{ beats in } s_8\ \iota x\ x \text{ is a donkey in } s_8)$ (by PA)

$= [\![\text{always}]\!]^{\emptyset}([\![\text{if}]\!]^{\emptyset}([\![\text{a}]\!]^{\emptyset}([\![\text{man}]\!]^{\emptyset})$
$(\lambda u_6.\, [\![\text{a}]\!]^{[6\to u_6]}([\![\text{donkey}]\!]^{[6\to u_6]})$
$(\lambda u_2.\, [\![\text{owns}]\!]^{\begin{bmatrix}6\to u_6\\2\to u_2\end{bmatrix}}\ ([\![\text{t}_2]\!]^{\begin{bmatrix}6\to u_6\\2\to u_2\end{bmatrix}})\ ([\![\text{t}_6]\!]^{\begin{bmatrix}6\to u_6\\2\to u_2\end{bmatrix}})))))$
$(\lambda s_8.\, \iota x\ x \text{ is a man in } s_8 \text{ beats in } s_8\ \iota x\ x \text{ is a donkey in } s_8)$ (by FA)

$= [\![\text{always}]\!]^{\emptyset}([\![\text{if}]\!]^{\emptyset}([\![\text{a}]\!]^{\emptyset}([\![\text{man}]\!]^{\emptyset})$
$(\lambda u_6.\, [\![\text{a}]\!]^{[6\to u_6]}([\![\text{donkey}]\!]^{[6\to u_6]})(\lambda u_2.\, [\![\text{owns}]\!]^{\begin{bmatrix}6\to u_6\\2\to u_2\end{bmatrix}}(u_2)(u_6)))))$
$(\lambda s_8.\, \iota x\ x \text{ is a man in } s_8 \text{ beats in } s_8\ \iota x\ x \text{ is a donkey in } s_8)$ (by TR)

$= [\![\text{always}]\!]^{\emptyset}([\![\text{if}]\!]^{\emptyset}([\![\text{a}]\!]^{\emptyset}([\![\text{man}]\!]^{\emptyset})\ (\lambda u_6.\, [\![\text{a}]\!]^{[6\to u_6]}([\![\text{donkey}]\!]^{[6\to u_6]})$
$(\lambda u_2.\, [\lambda u_3.\, \lambda u_4.\, \lambda s_9.\, u_4(s_9) \text{ owns } u_3(s_9) \text{ in } s_9](u_2)(u_6)))))$
$(\lambda s_8.\, \iota x\ x \text{ is a man in } s_8 \text{ beats in } s_8\ \iota x\ x \text{ is a donkey in } s_8)$ (by Lex)

$= [\![\text{always}]\!]^{\emptyset}([\![\text{if}]\!]^{\emptyset}([\![\text{a}]\!]^{\emptyset}([\![\text{man}]\!]^{\emptyset})\ (\lambda u_6.\, [\![\text{a}]\!]^{[6\to u_6]}([\![\text{donkey}]\!]^{[6\to u_6]})$
$(\lambda u_2.\, \lambda s_9.\, u_6(s_9) \text{ owns } u_2(s_9) \text{ in } s_9))))$
$(\lambda s_8.\, \iota x\ x \text{ is a man in } s_8 \text{ beats in } s_8\ \iota x\ x \text{ is a donkey in } s_8)$ (by λC)

$= [\![\text{always}]\!]^{\emptyset}([\![\text{if}]\!]^{\emptyset}([\![\text{a}]\!]^{\emptyset}([\![\text{man}]\!]^{\emptyset})$
$(\lambda u_6.\, [\lambda f_{\langle\langle s,e\rangle,\langle s,t\rangle\rangle}.\, \lambda g_{\langle\langle s,e\rangle,\langle s,t\rangle\rangle}.\, \lambda s_1.$ there is an individual x and a situation s_2 such that s_2 is a minimal situation such that $s_2 \leq s_1$ and $f(\lambda s_5.x)(s_2) = 1$, such that there is a situation s_3 such that $s_3 \leq s_1$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and $g(\lambda s_5.x)(s_3) = 1]$
$(\lambda u_3.\, \lambda s_6.\, u_3(s_6) \text{ is a donkey in } s_6)\ (\lambda u_2.\, \lambda s_9.\, u_6(s_9) \text{ owns } u_2(s_9) \text{ in } s_9))))$
$(\lambda s_8.\, \iota x\ x \text{ is a man in } s_8 \text{ beats in } s_8\ \iota x\ x \text{ is a donkey in } s_8)$ (by Lex)

$= [\![\text{always}]\!]^{\emptyset}([\![\text{if}]\!]^{\emptyset}([\![\text{a}]\!]^{\emptyset}([\![\text{man}]\!]^{\emptyset})\ (\lambda u_6.\, \lambda s_1.$ there is an individual x and a situation s_2 such that s_2 is a minimal situation such that $s_2 \leq s_1$ and $[\lambda u_3.\, \lambda s_6.\, u_3(s_6) \text{ is a donkey in } s_6]\ (\lambda s_5.x)(s_2) = 1$, such that there is a situation s_3 such that $s_3 \leq s_1$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and $[\lambda u_2.\, \lambda s_9.\, u_6(s_9) \text{ owns } u_2(s_9) \text{ in } s_9](\lambda s_5.x)(s_3) = 1)))$
$(\lambda s_8.\, \iota x\ x \text{ is a man in } s_8 \text{ beats in } s_8\ \iota x\ x \text{ is a donkey in } s_8)$ (by λC)

$= [\![\text{always}]\!]^{\emptyset}([\![\text{if}]\!]^{\emptyset}([\![\text{a}]\!]^{\emptyset}([\![\text{man}]\!]^{\emptyset})\ (\lambda u_6.\, \lambda s_1.$ there is an individual x and a situation s_2 such that s_2 is a minimal situation such that $s_2 \leq s_1$ and x is a donkey in s_2, such that there is a situation s_3 such that $s_3 \leq s_1$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and $u_6(s_3)$ owns x in s_3)))
$(\lambda s_8.\, \iota x\ x \text{ is a man in } s_8 \text{ beats in } s_8\ \iota x\ x \text{ is a donkey in } s_8)$ (by λC)

$= [\![\text{always}]\!]^{\emptyset}([\![\text{if}]\!]^{\emptyset}$ ($[\lambda f_{\langle\langle s,e\rangle,\langle s,t\rangle\rangle}.\, \lambda g_{\langle\langle s,e\rangle,\langle s,t\rangle\rangle}.\, \lambda s_6.$ there is an individual y and a situation s_7 such that s_7 is a minimal situation such that $s_7 \leq s_6$ and $f(\lambda s_5.y)(s_7) = 1$, such that there is a situation s_9 such that $s_9 \leq s_6$ and s_9 is a minimal situation such that $s_7 \leq s_9$ and $g(\lambda s_5.y)(s_9) = 1]$ $(\lambda u_3.\, \lambda s_4.u_3(s_4)$ is man in s_4) $(\lambda u_6.\, \lambda s_1.$ there is an individual x and a situation s_2 such that s_2 is a minimal situation such that $s_2 \leq s_1$ and x is a donkey in s_2, such that there is a situation s_3 such that $s_3 \leq s_1$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and $u_6(s_3)$ owns x in s_3)))
($\lambda s_8.\, \iota x$ x is a man in s_8 beats in s_8 ιx x is a donkey in s_8) (by Lex)

$= [\![\text{always}]\!]^{\emptyset}([\![\text{if}]\!]^{\emptyset}(\lambda s_6.$ there is an individual y and a situation s_7 such that s_7 is a minimal situation such that $s_7 \leq s_6$ and $[\lambda u_3.\, \lambda s_4.u_3(s_4)$ is man in $s_4](\lambda s_5.y)(s_7) = 1$, such that there is a situation s_9 such that $s_9 \leq s_6$ and s_9 is a minimal situation such that $s_7 \leq s_9$ and $[\lambda u_6.\, \lambda s_1.$ there is an individual x and a situation s_2 such that s_2 is a minimal situation such that $s_2 \leq s_1$ and x is a donkey in s_2, such that there is a situation s_3 such that $s_3 \leq s_1$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and $u_6(s_3)$ owns x in $s_3](\lambda s_5.y)(s_9) = 1$))
($\lambda s_8.\, \iota x$ x is a man in s_8 beats in s_8 ιx x is a donkey in s_8) (by λC)

$= [\![\text{always}]\!]^{\emptyset}([\![\text{if}]\!]^{\emptyset}(\lambda s_6.$ there is an individual y and a situation s_7 such that s_7 is a minimal situation such that $s_7 \leq s_6$ and y is man in s_7, such that there is a situation s_9 such that $s_9 \leq s_6$ and s_9 is a minimal situation such that $s_7 \leq s_9$ and there is an individual x and a situation s_2 such that s_2 is a minimal situation such that $s_2 \leq s_9$ and x is a donkey in s_2, such that there is a situation s_3 such that $s_3 \leq s_9$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and y owns x in s_3))
($\lambda s_8.\, \iota x$ x is a man in s_8 beats in s_8 ιx x is a donkey in s_8) (by λC)

$= [\![\text{always}]\!]^{\emptyset}([\lambda p_{\langle s,t\rangle}.\, p](\lambda s_6.$ there is an individual y and a situation s_7 such that s_7 is a minimal situation such that $s_7 \leq s_6$ and y is man in s_7, such that there is a situation s_9 such that $s_9 \leq s_6$ and s_9 is a minimal situation such that $s_7 \leq s_9$ and there is an individual x and a situation s_2 such that s_2 is a minimal situation such that $s_2 \leq s_9$ and x is a donkey in s_2, such that there is a situation s_3 such that $s_3 \leq s_9$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and y owns x in s_3))
($\lambda s_8.\, \iota x$ x is a man in s_8 beats in s_8 ιx x is a donkey in s_8) (by Lex)

$= [\![\text{always}]\!]^{\emptyset}(\lambda s_6.$ there is an individual y and a situation s_7 such that s_7 is a minimal situation such that $s_7 \leq s_6$ and y is man in s_7, such that there is a situation s_9 such that $s_9 \leq s_6$ and s_9 is a minimal situation such that $s_7 \leq s_9$ and there is an individual x and a situation s_2 such that s_2 is a minimal situation such that $s_2 \leq s_9$ and x is a donkey in s_2,

such that there is a situation s_3 such that $s_3 \leq s_9$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and y owns x in s_3)
($\lambda s_8 .\, \iota x$ x is a man in s_8 beats in s_8 ιx x is a donkey in s_8) (by λC)
$=$ [$\lambda p_{\langle s,t \rangle} .\, \lambda q_{\langle s,t \rangle} .\, \lambda s_1$. for every minimal situation s_4 such that $s_4 \leq s_1$ and $p(s_4) = 1$, there is a situation s_5 such that $s_5 \leq s_1$ and s_5 is a minimal situation such that $s_4 \leq s_5$ and $q(s_5) = 1$] (λs_6. there is an individual y and a situation s_7 such that s_7 is a minimal situation such that $s_7 \leq s_6$ and y is man in s_7, such that there is a situation s_9 such that $s_9 \leq s_6$ and s_9 is a minimal situation such that $s_7 \leq s_9$ and there is an individual x and a situation s_2 such that s_2 is a minimal situation such that $s_2 \leq s_9$ and x is a donkey in s_2, such that there is a situation s_3 such that $s_3 \leq s_9$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and y owns x in s_3)
($\lambda s_8 .\, \iota x$ x is a man in s_8 beats in s_8 ιx x is a donkey in s_8) (by Lex)
$= \lambda s_1$. for every minimal situation s_4 such that
$s_4 \leq s_1$ and there is an individual y and a situation s_7 such that s_7 is a minimal situation such that $s_7 \leq s_4$ and y is man in s_7, such that there is a situation s_9 such that $s_9 \leq s_4$ and s_9 is a minimal situation such that $s_7 \leq s_9$ and there is an individual x and a situation s_2 such that s_2 is a minimal situation such that $s_2 \leq s_9$ and x is a donkey in s_2, such that there is a situation s_3 such that $s_3 \leq s_9$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and y owns x in s_3,
there is a situation s_5 such that
$s_5 \leq s_1$ and s_5 is a minimal situation such that $s_4 \leq s_5$ and ιx x is a man in s_5 beats in s_5 ιx x is a donkey in s_5 (by λC)

B.2 A Relative-Clause Donkey Sentence

There follows a calculation establishing the truth conditions for a donkey sentence containing a QP and relative clause. See section 2.3.2.

$[\![$[[every [man [who [λ_6 [[a donkey] [λ_2 [t_6 owns t_2]]]]]]] [beats [it donkey]]]]$]\!]^{\emptyset}$
$= [\![$every$]\!]^{\emptyset}$ ($[\![$[man [who [λ_6 [[a donkey] [λ_2 [t_6 owns t_2]]]]]]$]\!]^{\emptyset}$)
($[\![$beats$]\!]^{\emptyset}$($[\![$it$]\!]^{\emptyset}$ ($[\![$donkey$]\!]^{\emptyset}$))) (by FA)
$= [\![$every$]\!]^{\emptyset}$ ($[\![$[man [who [λ_6 [[a donkey] [λ_2 [t_6 owns t_2]]]]]]$]\!]^{\emptyset}$)
([$\lambda u_1 .\, \lambda u_2 .\, \lambda s_8 .\, u_2(s_8)$ beats in s_8 $u_1(s_8)$]
([$\lambda f_{\langle\langle s,e \rangle, \langle s,t \rangle\rangle} .\, \lambda s_7 : \exists! x\, f(\lambda s_9 . x)(s_7) = 1 .\, \iota x\, f(\lambda s_9 . x)(s_7) = 1$]
($\lambda u_3 .\, \lambda s_6 .\, u_3(s_6)$ is a donkey in s_6))) (by Lex)

$= [\![\text{every}]\!]^{\emptyset} ([\![[\text{man [who } [\lambda_6 \text{ [[a donkey] } [\lambda_2 \text{ [t}_6 \text{ owns t}_2]]]]]]]\!]^{\emptyset})$
$([\lambda u_1 . \lambda u_2 . \lambda s_8 . u_2(s_8) \text{ beats in } s_8 \; u_1(s_8)]$
$(\lambda s_7 : \exists! x \; x \text{ is a donkey in } s_7 . \iota x \; x \text{ is a donkey in } s_7))$ (by λC)

$= [\![\text{every}]\!]^{\emptyset} ([\![[\text{man [who } [\lambda_6 \text{ [[a donkey] } [\lambda_2 \text{ [t}_6 \text{ owns t}_2]]]]]]]\!]^{\emptyset})$
$(\lambda u_2 . \lambda s_8 . u_2(s_8) \text{ beats in } s_8 \; \iota x \; x \text{ is a donkey in } s_8)$ (by λC)

$= [\![\text{every}]\!]^{\emptyset} (\lambda u_1 . \lambda s_7 . [\![\text{man}]\!]^{\emptyset}(u_1)(s_7) = 1 \text{ and}$
$[\![[\text{who } [\lambda_6 \text{ [[a donkey] } [\lambda_2 \text{ [t}_6 \text{ owns t}_2]]]]]]\!]^{\emptyset}(u_1)(s_7) = 1)$
$(\lambda u_2 . \lambda s_8 . u_2(s_8) \text{ beats in } s_8 \; \iota x \; x \text{ is a donkey in } s_8)$ (by PM)

$= [\![\text{every}]\!]^{\emptyset} (\lambda u_1 . \lambda s_7 . [\lambda u_3 . \lambda s_3 . u_3(s_3) \text{ is man in } s_3](u_1)(s_7) = 1 \text{ and}$
$[\![[\text{who } [\lambda_6 \text{ [[a donkey] } [\lambda_2 \text{ [t}_6 \text{ owns t}_2]]]]]]\!]^{\emptyset}(u_1)(s_7) = 1)$
$(\lambda u_2 . \lambda s_8 . u_2(s_8) \text{ beats in } s_8 \; \iota x \; x \text{ is a donkey in } s_8)$ (by Lex)

$= [\![\text{every}]\!]^{\emptyset} (\lambda u_1 . \lambda s_7 . u_1(s_7) \text{ is a man in } s_7 \text{ and}$
$[\![[\text{who } [\lambda_6 \text{ [[a donkey] } [\lambda_2 \text{ [t}_6 \text{ owns t}_2]]]]]]\!]^{\emptyset}(u_1)(s_7) = 1)$
$(\lambda u_2 . \lambda s_8 . u_2(s_8) \text{ beats in } s_8 \; \iota x \; x \text{ is a donkey in } s_8)$ (by λC)

$= [\![\text{every}]\!]^{\emptyset} (\lambda u_1 . \lambda s_7 . u_1(s_7) \text{ is a man in } s_7 \text{ and}$
$[\![[\lambda_6 \text{ [[a donkey] } [\lambda_2 \text{ [t}_6 \text{ owns t}_2]]]]]\!]^{\emptyset}(u_1)(s_7) = 1)$
$(\lambda u_2 . \lambda s_8 . u_2(s_8) \text{ beats in } s_8 \; \iota x \; x \text{ is a donkey in } s_8)$ (by Lex)

$= [\![\text{every}]\!]^{\emptyset} (\lambda u_1 . \lambda s_7 . u_1(s_7) \text{ is a man in } s_7 \text{ and}$
$\lambda u_6 . [\![[\text{[a donkey] } [\lambda_2 \text{ [t}_6 \text{ owns t}_2]]]]\!]^{[6 \to u_6]}(u_1)(s_7) = 1)$
$(\lambda u_2 . \lambda s_8 . u_2(s_8) \text{ beats in } s_8 \; \iota x \; x \text{ is a donkey in } s_8)$ (by PA)

$= [\![\text{every}]\!]^{\emptyset} (\lambda u_1 . \lambda s_7 . u_1(s_7) \text{ is a man in } s_7 \text{ and}$
$[\![[\text{[a donkey] } [\lambda_2 \text{ [t}_6 \text{ owns t}_2]]]]\!]^{[6 \to u_1]}(s_7) = 1)$
$(\lambda u_2 . \lambda s_8 . u_2(s_8) \text{ beats in } s_8 \; \iota x \; x \text{ is a donkey in } s_8)$ (by λC)

$= [\![\text{every}]\!]^{\emptyset} (\lambda u_1 . \lambda s_7 . u_1(s_7) \text{ is a man in } s_7 \text{ and}$
$[[\![\text{a}]\!]^{[6 \to u_1]}([\![\text{donkey}]\!]^{[6 \to u_1]})([\![\lambda_2 \text{ [t}_6 \text{ owns t}_2]]\!]^{[6 \to u_1]})](s_7) = 1)$
$(\lambda u_2 . \lambda s_8 . u_2(s_8) \text{ beats in } s_8 \; \iota x \; x \text{ is a donkey in } s_8)$ (by FA)

$= [\![\text{every}]\!]^{\emptyset} (\lambda u_1 . \lambda s_7 . u_1(s_7) \text{ is a man in } s_7 \text{ and}$
$[[\![\text{a}]\!]^{[6 \to u_1]}([\![\text{donkey}]\!]^{[6 \to u_1]})(\lambda u_4 . [\![\text{t}_6 \text{ owns t}_2]\!]^{\left[\begin{smallmatrix} 6 \to u_1 \\ 2 \to u_4 \end{smallmatrix}\right]})](s_7) = 1)$
$(\lambda u_2 . \lambda s_8 . u_2(s_8) \text{ beats in } s_8 \; \iota x \; x \text{ is a donkey in } s_8)$ (by PA)

$= [\![\text{every}]\!]^{\emptyset} (\lambda u_1 . \lambda s_7 . u_1(s_7) \text{ is a man in } s_7 \text{ and}$
$[[\![\text{a}]\!]^{[6 \to u_1]}([\![\text{donkey}]\!]^{[6 \to u_1]})$
$(\lambda u_4 . [\![\text{owns}]\!]^{\left[\begin{smallmatrix} 6 \to u_1 \\ 2 \to u_4 \end{smallmatrix}\right]}([\![\text{t}_2]\!]^{\left[\begin{smallmatrix} 6 \to u_1 \\ 2 \to u_4 \end{smallmatrix}\right]})([\![\text{t}_6]\!]^{\left[\begin{smallmatrix} 6 \to u_1 \\ 2 \to u_4 \end{smallmatrix}\right]}))](s_7) = 1)$
$(\lambda u_2 . \lambda s_8 . u_2(s_8) \text{ beats in } s_8 \; \iota x \; x \text{ is a donkey in } s_8)$ (by FA)

$= [\![\text{every}]\!]^{\emptyset} (\lambda u_1 . \lambda s_7 . u_1(s_7) \text{ is a man in } s_7 \text{ and}$
$[[\![\text{a}]\!]^{[6 \to u_1]}([\![\text{donkey}]\!]^{[6 \to u_1]})$
$(\lambda u_4 . [\![\text{owns}]\!]^{\left[\begin{smallmatrix} 6 \to u_1 \\ 2 \to u_4 \end{smallmatrix}\right]}(u_4)(u_1))](s_7) = 1)$
$(\lambda u_2 . \lambda s_8 . u_2(s_8) \text{ beats in } s_8 \; \iota x \; x \text{ is a donkey in } s_8)$ (by TR)

$= [\![\text{every}]\!]^{\emptyset}$ $(\lambda u_1.\, \lambda s_7.\, u_1(s_7)$ is a man in s_7 and
$[[\![\text{a}]\!]^{[6\to u_1]}([\![\text{donkey}]\!]^{[6\to u_1]})$
$(\lambda u_4.\, [\lambda u_5.\, \lambda u_6.\, \lambda s_9.\, u_6(s_9)$ owns $u_5(s_9)$ in $s_9](u_4)(u_1))](s_7) = 1)$
$(\lambda u_2.\, \lambda s_8.\, u_2(s_8)$ beats in s_8 ιx x is a donkey in $s_8)$ (by Lex)
$= [\![\text{every}]\!]^{\emptyset}$ $(\lambda u_1.\, \lambda s_7.\, u_1(s_7)$ is a man in s_7 and
$[[\![\text{a}]\!]^{[6\to u_1]}([\![\text{donkey}]\!]^{[6\to u_1]})$
$(\lambda u_4.\, \lambda s_9.\, u_1(s_9)$ owns $u_4(s_9)$ in $s_9)](s_7) = 1)$
$(\lambda u_2.\, \lambda s_8.\, u_2(s_8)$ beats in s_8 ιx x is a donkey in $s_8)$ (by λC)
$= [\![\text{every}]\!]^{\emptyset}$ $(\lambda u_1.\, \lambda s_7.\, u_1(s_7)$ is a man in s_7 and
$[[\lambda f_{\langle\langle s,e\rangle,\langle s,t\rangle\rangle}.\, \lambda g_{\langle\langle s,e\rangle,\langle s,t\rangle\rangle}.\, \lambda s_1.$ there is an individual x and a situation s_2 such that s_2 is a minimal situation such that $s_2 \leq s_1$ and $f(\lambda s_5.x)(s_2) = 1$, such that there is a situation s_3 such that $s_3 \leq s_1$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and $g(\lambda s_5.x)(s_3) = 1]$
$(\lambda u_3.\, \lambda s_6.\, u_3(s_6)$ is a donkey in $s_6)$ $(\lambda u_4.\, \lambda s_9.\, u_1(s_9)$ owns $u_4(s_9)$ in $s_9)]$
$(s_7) = 1)$
$(\lambda u_2.\, \lambda s_8.\, u_2(s_8)$ beats in s_8 ιx x is a donkey in $s_8)$ (by Lex)
$= [\![\text{every}]\!]^{\emptyset}$ $(\lambda u_1.\, \lambda s_7.\, u_1(s_7)$ is a man in s_7 and $[\lambda s_1.$ there is an individual x and a situation s_2 such that s_2 is a minimal situation such that $s_2 \leq s_1$ and x is a donkey in s_2, such that there is a situation s_3 such that $s_3 \leq s_1$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and $u_1(s_3)$ owns x in $s_3](s_7) = 1)$
$(\lambda u_2.\, \lambda s_8.\, u_2(s_8)$ beats in s_8 ιx x is a donkey in $s_8)$ (by λC)
$= [\![\text{every}]\!]^{\emptyset}$ $(\lambda u_1.\, \lambda s_7.\, u_1(s_7)$ is a man in s_7 and there is an individual x and a situation s_2 such that s_2 is a minimal situation such that $s_2 \leq s_7$ and x is a donkey in s_2, such that there is a situation s_3 such that $s_3 \leq s_7$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and $u_1(s_3)$ owns x in $s_3)$ $(\lambda u_2.\, \lambda s_8.\, u_2(s_8)$ beats in s_8 ιx x is a donkey in $s_8)$ (by λC)
$= [\lambda f_{\langle\langle s,e\rangle,\langle s,t\rangle\rangle}.\, \lambda g_{\langle\langle s,e\rangle,\langle s,t\rangle\rangle}.\, \lambda s_4.$ for every individual y: for every minimal situation s_5 such that $s_5 \leq s_4$ and $f(\lambda s_1.y)(s_5) = 1$, there is a situation s_6 such that $s_6 \leq s_4$ and s_6 is a minimal situation such that $s_5 \leq s_6$ and $g(\lambda s_1.y)(s_6) = 1]$ $(\lambda u_1.\, \lambda s_7.\, u_1(s_7)$ is a man in s_7 and there is an individual x and a situation s_2 such that s_2 is a minimal situation such that $s_2 \leq s_7$ and x is a donkey in s_2, such that there is a situation s_3 such that $s_3 \leq s_7$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and $u_1(s_3)$ owns x in $s_3)$
$(\lambda u_2.\, \lambda s_8.\, u_2(s_8)$ beats in s_8 ιz z is a donkey in $s_8)$ (by Lex)
$= \lambda s_4.$ for every individual y: for every minimal situation s_5 such that $s_5 \leq s_4$ and $[\lambda u_1.\, \lambda s_7.\, u_1(s_7)$ is a man in s_7 and there is an individual x and a situation s_2 such that s_2 is a minimal situation such that $s_2 \leq s_7$ and x is a donkey in s_2, such that there is a situation s_3 such that

$s_3 \leq s_7$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and $u_1(s_3)$ owns x in $s_3](\lambda s_1.y)(s_5) = 1$, there is a situation s_6 such that $s_6 \leq s_4$ and s_6 is a minimal situation such that $s_5 \leq s_6$ and $[\lambda u_2. \lambda s_8. u_2(s_8)$ beats in s_8 ιz z is a donkey in $s_8](\lambda s_1.y)(s_6) = 1$ (by λC)

$= \lambda s_4$. for every individual y:

for every minimal situation s_5 such that

$s_5 \leq s_4$ and y is a man in s_5 and there is an individual x and a situation s_2 such that s_2 is a minimal situation such that $s_2 \leq s_5$ and x is a donkey in s_2, such that there is a situation s_3 such that $s_3 \leq s_5$ and s_3 is a minimal situation such that $s_2 \leq s_3$ and y owns x in s_3,

there is a situation s_6 such that

$s_6 \leq s_4$ and s_6 is a minimal situation such that $s_5 \leq s_6$ and y beats in s_6 ιz z is a donkey in s_6 (by λC)