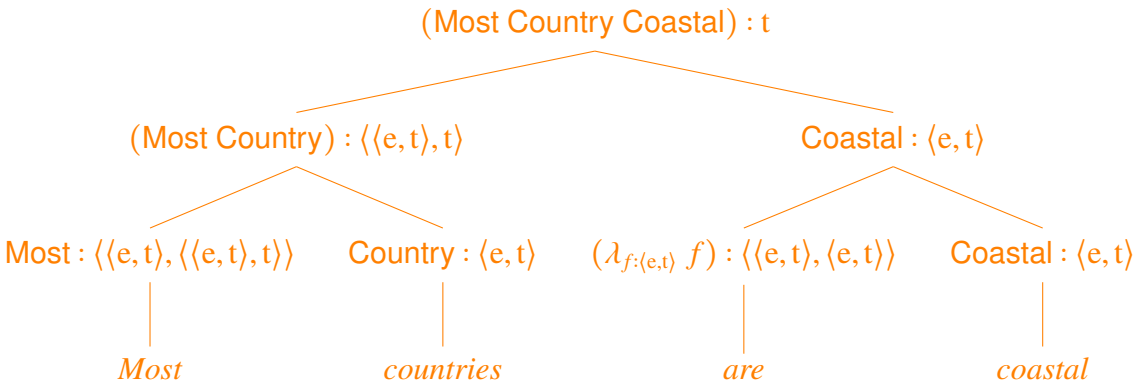
LING4400: Lecture Notes 6
Other higher-order functions

Contents

6.1 Identity functions

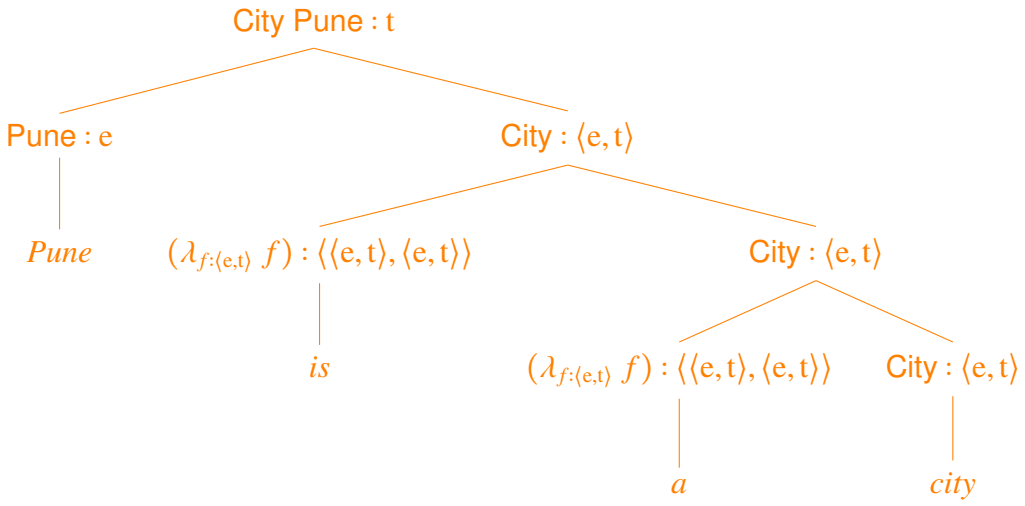
Adjective phrases can work like predicate verb phrases too, but they need a copula like 'are':



This uses an **identity function** of type $\langle\langle e,t\rangle,\langle e,t\rangle\rangle$ for the copula auxiliary verb (*be*, *is*, *are*, etc.):

$$[\![\text{Identity}]\!]^M = [\![\lambda_{f:\langle e,t\rangle}\ f]\!]^M.$$

A similar function can be defined for *a* in this context:



6.2 Comparative quantifiers

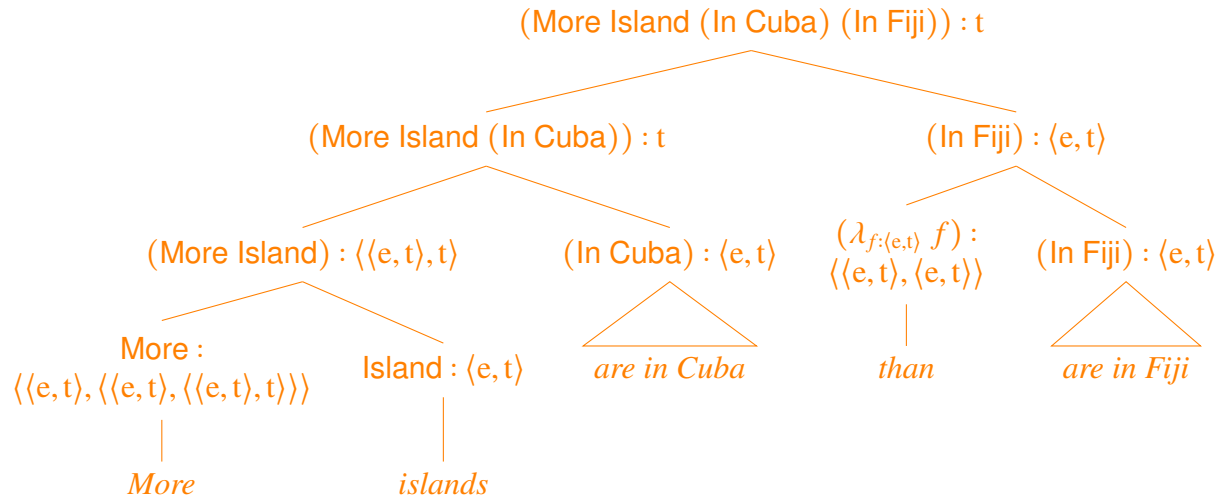
We can also model certain types of comparatives as quantifiers:

(1) a. *1,600 islands are in Cuba.*
b. *300 islands are in Fiji.*
c. (entailed by 1a and 1b:) *More islands are in Cuba than are in Fiji.*

The function is of type $\langle\langle e,t\rangle,\langle\langle e,t\rangle,\langle\langle e,t\rangle,t\rangle\rangle\rangle$:

$$[\![\text{More}]\!]^M = [\![\lambda_{r:\langle e,t\rangle}\ \lambda_{s:\langle e,t\rangle}\ \lambda_{t:\langle e,t\rangle}\ |\lambda_{x:e}\ r\ x \wedge s\ x| > |\lambda_{x:e}\ r\ x \wedge t\ x|]\!]^M$$
$$= [\![\lambda_{r:\langle e,t\rangle}\ \lambda_{s:\langle e,t\rangle}\ \lambda_{t:\langle e,t\rangle}\ \text{Count}_{>}\ |\lambda_{x:e}\ r\ x \wedge t\ x|\ r\ s]\!]^M$$

For example:



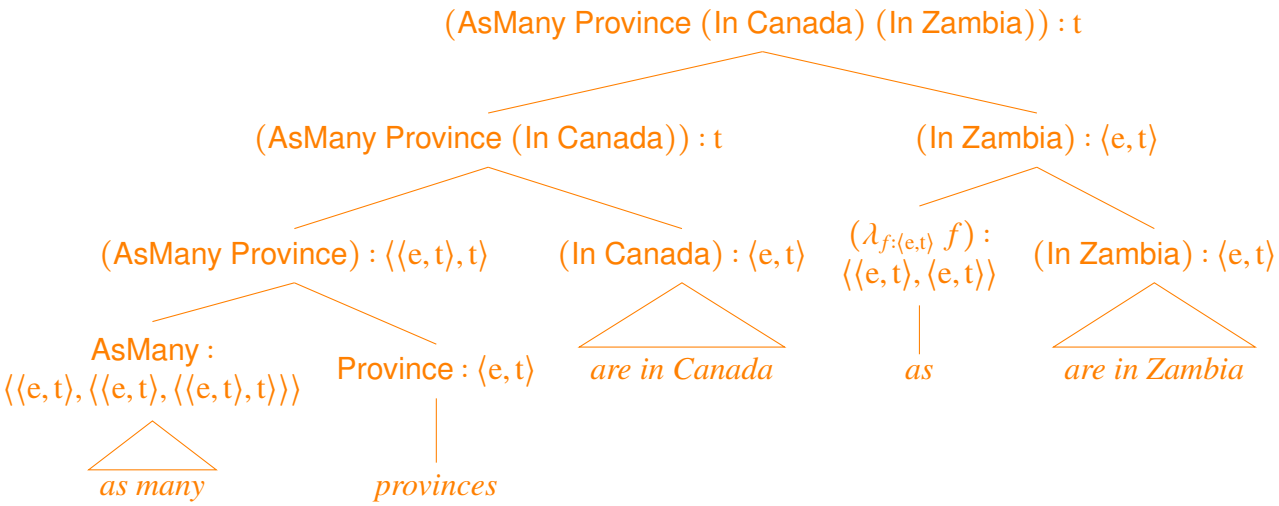
6.3 Equative quantifiers

(2) a. *10 provinces are in Canada.*
b. *10 provinces are in Zambia.*
c. (entailed by 2a and 2b:) *As many provinces are in Canada as are in Zambia.*

The function is of type $\langle\langle e,t\rangle,\langle\langle e,t\rangle,\langle\langle e,t\rangle,t\rangle\rangle\rangle$:

$$[\![\text{AsMany}]\!]^M = [\![\lambda_{r:\langle e,t\rangle}\ \lambda_{s:\langle e,t\rangle}\ \lambda_{t:\langle e,t\rangle}\ |\lambda_{x:e}\ r\ x \wedge s\ x| = |\lambda_{x:e}\ r\ x \wedge t\ x|]\!]^M$$
$$= [\![\lambda_{r:\langle e,t\rangle}\ \lambda_{s:\langle e,t\rangle}\ \lambda_{t:\langle e,t\rangle}\ \text{Count}_{=}\ |\lambda_{x:e}\ r\ x \wedge t\ x|\ r\ s]\!]^M$$

For example:


(AsMany Province (In Canada) (In Zambia)) : t
(AsMany Province (In Canada)) : t
(In Zambia) : ⟨e, t⟩
(AsMany Province) : ⟨⟨e, t⟩, t⟩
(In Canada) : ⟨e, t⟩
(λf:⟨e,t⟩ f) : ⟨⟨e, t⟩, ⟨e, t⟩⟩
(In Zambia) : ⟨e, t⟩
AsMany : ⟨⟨e, t⟩, ⟨⟨e, t⟩, ⟨⟨e, t⟩, t⟩⟩⟩
Province : ⟨e, t⟩
are in Canada
as
are in Zambia
as many
provinces