## 8.3.s. Summary

8.3.1. When the word *else* appears as a modifier in a quantifier phrase, it is used to restrict the domain by excluding some previously mentioned object; that is, it amounts to something like *other than it*. An existential quantifier phrase modified by it thus claims the existence of a new example.

8.3.2. The same sort of restriction can be used to express a variety of numerical quantifier phrases. For example, *at least 2 things* amounts to *something and something else*, and *at least 3 things* amounts to *something and something else and something other than those two*. The quantifiers used may be restricted, so that *At least two* C*s are such that (… they …)* can be expressed as:

(∃x: x *is a* C) (∃y: y *is a* C ∧ ¬ y = x) ( … x … ∧ … y … )

Still other numerical claims can be reached by truth-functional compounding—*at most n* by denying *at least* n+1 and *exactly n* by conjoining claims stated with *at least n* and *at most n*.

8.3.3. It is also possible to express *Exactly 1 thing is such that (… it …)* by *Something is such that (… it … and nothing else does)* or—equivalently, in a way that illustrates, among other things, a principle of contraposition—by *Something is such that (… it … and it is all that does)*.

## 8.3.x. Exercise questions

**1.** Analyze the following in as much detail as possible.

- **a.** *If Oswald didn't shoot Kennedy, someone else did*.
- **b.** *No one but Frank saw Sue*.
- **c.** *Ed and only Ed was awake*.
- **d.** *Everyone except Tom, Dick, and Harry arrived early*.
- **e.** *Adam and another officer thanked everyone else*.
- **f.** *At least two things went wrong*.
- **g.** *Bill spoke to at most one person*.
- **h.** *Just one thing will do*.
- **i.** *Ann saw more than one assassin*.
- **j.** *Ann saw exactly two assassins*.

**2.** Synthesize idiomatic English sentences that express the propositions associated with the logical forms below using the intensional interpretations that follow them.

- **a.** Fth ∧ (∃x: ¬ x = h) Ltx
  [F: λxy (x *found* y); L: λxy (x *lost* y); h: *Tom's hat*; t: *Tom*]
- **b.** (∃x: Px) (∃y: Py ∧ ¬ y = x) Sxy
  [P: λx (x *is a person*); S: λxy (x *spoke to* y)]
- **c.** (∀x: Px ∧ ¬ x = m) ¬ Rsx
  [P: λx (x *is a person*); R: λxy (x *recognized* y); m: *Mary*; s: *Sam*]
- **d.** (∃x: Sx) Ox ∧ ¬ (∃x: Sx) (∃y: Sy ∧ ¬ y = x) (Ox ∧ Oy)
  [S: λx (x *is a store*); O: λx (x *was open*)]

## Homework assigned Fri 12/3 and due Mon 12/6

(i) Analyze the following in as much detail as possible:

*Sam saw at least 2 deer but no one else saw any*

(ii) Use derivations to show: ∀x (∀y: Fy) Rxy ⇒ (∀x: Fx) ∀y Ryx