

Tuesday, September 22

Name SOLUTIONS

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Miniquiz #9

5 Minutes

1. Consider the extension to IMP that we saw last lecture, which adds heaps to the language.

- a) Suppose we would like to define a new type of statement  $x \text{ }^*= e$ , which evaluates the expression  $e$  and stores its result to the heap at the address that variable  $x$  maps to. Write the inference rule for the statement  $x \text{ }^*= e$ :

$$\frac{(\sigma, h, e) \rightarrow n \quad \sigma(x) = a \quad h[a : n] = h'}{(\sigma, h, x \text{ }^*= e) \rightarrow (\sigma, h')}$$

- b) Now suppose the language also supports a new type of statement  $x \text{ }<= y$ , whose semantics is defined by the following inference rule:

$$\frac{\sigma(y) = a \quad \sigma[x : a] = \sigma'}{(\sigma, h, x \text{ }<= y) \rightarrow (\sigma', h)}$$

Assuming an initial frame  $\sigma = \{x : 100\}$  and an initial heap  $h = \{100 : 1\}$ , what is a possible set of frame and heap after the following program is executed?

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y <= x;  
y *= 2 + 3;  
z = x * y;
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$$\begin{aligned}\sigma' &= \{x : 100, y : 100, z : 200\} \\ h' &= \{100 : 5, 200 : 25\}\end{aligned}$$