

## Activity: State Updates

### A. Why?

To understand how programs work, we must understand state updates; they're how we change the state of memory as a program executes.

### B. Outcomes

By the end of the activity you should

- Be able to read, write, and use simple state updates.

### C. Questions

As usual, form groups of 5, assign roles, and answer the following questions. Email the results to [f09cs536@gmail.com](mailto:f09cs536@gmail.com)

1. Let  $\sigma_0(x) = 12$  and  $\sigma_0(y)$  be undefined; let  $\sigma_1$  be the state  $\sigma_0$  updated so to map  $x$  to 4 and (then updated to map)  $y$  to 8. Fill in the ??? below to define  $\sigma_1$  using the textbook's notation:

$$\sigma_1 = \sigma[ \text{???} := \text{???} ][ \text{???} := \text{???} ]$$

$$\sigma_1 = \sigma[ x := 4 ] [ y := 8 ]$$

2. For purposes of knowing how  $\sigma_1$  behaves, does it matter what  $\sigma_0(x)$  and  $\sigma_0(y)$  are?

No, it doesn't matter.

3. Translate the following into notation: " $\tau_1$  is  $\tau_0$  updated to map  $q$  to 2."

$$\tau_1 = \tau_0[q := 2]$$

4. Translate the following into English: " $\tau[z := \tau(x+y)]$  where  $\tau = \sigma[x := 1][y := 2]$ ."

$\tau$  updated at  $z$  to  $\tau$  applied to  $x+y$  where  $\tau$  is  $\sigma$  updated at  $x$  to 1 and (then)  $y$  to 2.

5. Let  $\sigma_2 = \sigma[y := 8][x := 4]$ . Are  $\sigma_1$  and  $\sigma_2$  equal? (Remember, they're functions.)

What about  $\sigma[x := 8][x := 4]$  and  $\sigma[x := 4][x := 8]$ ?

Yes,  $\sigma_1 = \sigma_2$ . No, the last two aren't equal because they behave differently on  $x$

6. Say  $u$  and  $v$  are variables that might or might not be  $\equiv$ ; complete the following

statement:  $\sigma[u := \alpha][v := \beta] = \sigma[v := \beta][u := \alpha]$  iff ( $u$  not  $\equiv v$  or ???).

$u \equiv v$  but  $\alpha \neq \beta$ .