Errata for the *Semantics of Programming Languages* Notes

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The updated notes available on the course web page includes all these corrections, together with other improvements.

1. Slide 51, *Executing L1 in mosml*, omitted a definition of **skip** = (). It should read:

   L1 is essentially a fragment of mosml - given a typable L1 expression e and an initial store s, e can be executed in mosml by wrapping it

   ```
   let val skip = ()
       and l1 = ref n1
       and l2 = ref n2
       ..
       and lk = ref nk
   in
     e
   end;
   ```

   where s is the store $\{l_1 \mapsto n_1, ..., l_k \mapsto n_k\}$ and all locations that occur in e are contained in $\{l_1, ..., l_k\}$. (watch out for ∼1 and -1).

2. The printing process misaligned the $\mapsto$ arrows used for writing partial maps. They should be rendered with the short vertical at the left end of the arrow. Negated turnstiles $\nvdash$ were also misprinted; they should render as a turnstile $\vdash$ with a slash through it.

3. The l1 code omitted a clause for **if** .

4. On Slide 92, the second clause of the definition of substitution should read

$$\{e/z\}(\textbf{fn}\ x{:}T \Rightarrow e_1) \quad = \quad \textbf{fn}\ x{:}T \Rightarrow (\{e/z\}e_1) \qquad \begin{array}{l}\text{if } x \neq z\ (*)\\ \text{and } x \notin \mathrm{fv}(e)\ (*)\end{array}$$

   if (*) is not true, we first have to pick an alpha-variant of **fn** $x{:}T \Rightarrow e_1$ to make it so (always can)

5. On Page 13, the two $\mathbb{N}$ should be $\mathbb{Z}$.

6. On Slide 112, the last expression should be **let val rec** $f{:}T_1 \to T_2 =$ **fn** $x{:}T_1 \Rightarrow e_1$ **in** e_2 **end**.

7. On Page 73, two () should be **skip**.

8. One of the L3 rules for records was omitted – add:

$$\text{(record3)} \quad \frac{\langle e, s\rangle \longrightarrow \langle e', s'\rangle}{\langle \#lab_i\ e, s\rangle \longrightarrow \langle \#lab_i\ e', s'\rangle}$$

   (a) (an errata erratum) That rule has e' not e on the right of the conclusion

9. One of the L3 rules for references was omitted – add:

$$\text{(loc)} \quad \frac{\Gamma(\ell) = T\ \mathsf{ref}}{\Gamma \vdash \ell{:}T\ \mathsf{ref}}$$

10. The statement of store typing for L3 was missing a ref; it should be

    $\Gamma \vdash s$ if $\forall \ell \in \mathrm{dom}(s).\exists T.\Gamma(\ell) = T\ \mathsf{ref} \wedge \Gamma \vdash s(\ell){:}T$.

11. In the proof of Determinacy, the start of the $e_1\ op\ e_2$ case had a bogus $l :=$. It should read:

    Case $e_1\ op\ e_2$. Suppose $\Phi(e_1)$ and $\Phi(e_2)$.

    Take arbitrary s, e', s', e'', s'' such that $\langle e_1\ op\ e_2, s\rangle \longrightarrow \langle e', s'\rangle \wedge \langle e_1\ op\ e_2, s\rangle \longrightarrow \langle e'', s''\rangle$.

12. The precise definition of the Ordered 2PL discipline should be as below

Slide 1

Now can make the Ordered 2PL Discipline precise

Say e obeys the discipline if for any (finite or infinite)
$e \xrightarrow{a_1} e_1 \xrightarrow{a_2} e_2 \xrightarrow{a_3} \ldots$

- if a_i is $(l_j := n)$ or $(!l_j = n)$ then for some $k < i$ we have $a_k =$ **lock** m_j without an intervening **unlock** m_j.
- for each j, the subsequence of $a_1, a_2, \ldots$ with labels **lock** m_j and **unlock** m_j is a prefix of $((\textbf{lock}\ \mathrm{m}_j)(\textbf{unlock}\ \mathrm{m}_j))^*$. Moreover, if $\neg(e_k \xrightarrow{a})$ then the subsequence does not end in a **lock** m_j.
- if $a_i =$ **lock** m_j and $a_{i'} =$ **unlock** $\mathrm{m}_{j'}$ then $i < i'$
- if $a_i =$ **lock** m_j and $a_{i'} =$ **lock** $\mathrm{m}_{j'}$ and $i < i'$ then $j < j'$

13. The precise definition of deadlock-freedom should have an s' instead of an s in the final state.