

Exercise 2:

Evaluate the following using lexical environment semantics with stores.

let $x = \text{ref } 42$ in $(x := !x - 21; !x) + !x$;

Solution:

multisteps

R_{let}
 R_{ref}
 R_{ref}
 R_{let}
 R_{+}
 R_{seq}
 R_{assign}
 R_{assign}
 R_{+}
 R_{deref}
 R_{deref}
 R_{+}
 R_{+}
 R_{assign}
 R_{seq}
 R_{deref}
 R_{deref}
 R_{seq}
 R_{+}
 R_{+}
 R_{let}

$\{\}, \{\} \vdash \text{let } x = \text{ref } 42 \text{ in } (x := !x - 21; !x) + !x$
 \downarrow
 $\{\}, \{\} \vdash \text{ref } 42$
 \downarrow
 $\{\}, \{\} \vdash 42$
 \downarrow
 $\{x \mapsto 42\}$
 \downarrow
 $\{x \mapsto 42\} \vdash (x := !x - 21; !x) + !x$
 \downarrow
 $\{x \mapsto 42\} \vdash (x := !x - 21; !x)$
 \downarrow
 $\{x \mapsto 42\} \vdash x := !x - 21$
 \downarrow
 $\{x \mapsto 42\} \vdash x$
 \downarrow
 $\{x \mapsto 42\} \vdash !x$
 \downarrow
 $\{x \mapsto 42\} \vdash x$
 \downarrow
 $\{x \mapsto 42\} \vdash 21$
 \downarrow
 $\{x \mapsto 21\}$
 \downarrow
 $\{x \mapsto 21\} \vdash !x$
 \downarrow
 $\{x \mapsto 21\} \vdash x$
 \downarrow
 $\{x \mapsto 21\} \vdash !x$
 \downarrow
 $\{x \mapsto 21\} \vdash 21$
 \downarrow
 $\{x \mapsto 21\} \vdash !x$
 \downarrow
 $\{x \mapsto 21\} \vdash 42$
 \downarrow
 $\{x \mapsto 21\} \vdash 63$

return steps

R_{int}
 R_{ref}

R_{var}

R_{var}
 R_{deref}
 R_{int}
 R_{+}

R_{assign}

R_{var}
 R_{deref}
 R_{seq}
 $R_{\text{var}}, R_{\text{deref}}$
 R_{+}
 R_{let}

