Assignment 1

Will Crichton (wcrichto)

Problem 1

Part 1:

$$
\begin{aligned}
\textsf{Property } p1 ::= &\quad (> 0 \ \wedge < 5) \ \vee = 10 \\
p2 ::= &\quad =' X' \vee =' Y' \\
p3 ::= &\quad \varepsilon
\end{aligned}
$$

$$
\begin{aligned}
\textsf{Schema } \tau ::= &\quad \textsf{num}\langle p1 \rangle \\
| &\quad \{'\textsf{a}' : \textsf{bool}, '\textsf{b}' : \textsf{string}\langle p2 \rangle\} \\
| &\quad [\{'\textsf{x}' : \textsf{num}\langle p3 \rangle\}]
\end{aligned}
$$

Part 2:

$$\frac{}{\textsf{false} \sim \textsf{bool}} \text{ (S-Bool-False)} \qquad \frac{}{\textsf{true} \sim \textsf{bool}} \text{ (S-Bool-True)} \qquad \frac{n \in \mathbb{Z}}{n \sim \textsf{num}} \text{ (S-Num)}$$

$$\frac{a \in \{'a' \ldots' z', 'A' \ldots' Z'\}}{a^+ \sim \textsf{string}} \text{ (S-String)} \qquad \frac{n \sim \textsf{num} \quad (n > 0 \wedge n < 5) \vee n = 10}{n \sim \tau} \text{ (S-Num-Correct)}$$

$$\frac{v1 \sim \textsf{bool} \quad v2 \sim \textsf{string} \quad v2 =' X' \vee v2 =' Y'}{\{'a' : v1, 'b' : v2\} \sim \tau} \text{ (S-Dict-Correct)}$$

$$\frac{v1 \sim \textsf{num}}{[(\{'x' : v1\})^*] \sim \tau} \text{ (S-Array-Correct)}$$

Problem 2

Part 1:

$$\frac{}{(\varepsilon, j) \mapsto (\varepsilon, j)}\ \text{(D-Epsilon)} \qquad \frac{j \sim \{s : j'\}}{(.sa, j) \mapsto (a, j_s)}\ \text{(D-Dict-Extract)}$$

$$\frac{j \sim [j']}{(.[n]a, j) \mapsto (a, j_n)}\ \text{(D-Array-Extract)}$$

$$\frac{j \sim [\{s : j'\}] \wedge a = .sa'}{(|a, j) \mapsto (a', [j[0]_s, j[1]_s, \ldots, j[|j| - 1]_s])}\ \text{(D-Maps-Over-Array-of-Dicts)}$$

$$\frac{j \sim [[j']] \wedge a = [n]a'}{(|a, j) \mapsto (a', [j[0][n], j[1][n], \ldots, j[|j| - 1][n]])}\ \text{(D-Maps-Over-Array-of-Array)}$$

Part 2:

Accessor safety: for all a, j, τ, if $a \sim \tau$ and $j \sim \tau$, then there exists a j' such that $(a, j) \overset{*}{\mapsto} \varepsilon, j'$.

证明. □