Homework #4

CS320, Fall 2019

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Consider the following `F1WAE`

$d ::=$	`{deffun {`x x`} `e`}`	function definition	$d \in$	`FunDef`
$e ::=$	n	number	$e \in$	`F1WAE`
$\mid$	`{+ `e e`}`	addition	$n \in$	$\mathbb{Z}$
$\mid$	`{with {`x e`} `e`}`	identifier introduction	$x \in$	Var
$\mid$	x	identifier	$\sigma \in$	$Var \xrightarrow{\text{fin}} \mathbb{Z}$
$\mid$	`{`x e`}`	function application	$\Lambda \in$	$Var \xrightarrow{\text{fin}}$ `FunDef`

Write the operational semantics of the form $\boxed{\sigma, \Lambda \vdash e \Rightarrow n}$.

n : $\sigma, \Lambda \vdash n \Rightarrow n$

$\{+\ e\ e\}$: $$\frac{\sigma, \Lambda \vdash e_1 \Rightarrow n_1 \quad \sigma, \Lambda \vdash e_2 \Rightarrow n_2}{\sigma, \Lambda \vdash \{+\ e_1\ e_2\} \Rightarrow n_1 + n_2}$$

$\{with\ \{x\ e\}\ e\}$: $$\frac{\sigma, \Lambda \vdash e_1 \Rightarrow n_1 \quad \sigma[x \mapsto n_1], \Lambda \vdash e_2 \Rightarrow n_2}{\sigma, \Lambda \vdash \{with\ \{x\ e\}\ e\} \Rightarrow n_2}$$

x : $$\frac{x \in domain(\sigma)}{\sigma, \Lambda \vdash x \Rightarrow \sigma(x)}$$

$\{x\ e\}$: $$\frac{\dfrac{x \in domain(\Lambda)}{\Lambda(x) = \{deffun\ \{x\ x'\}\ e'\}} \quad \sigma, \Lambda \vdash e \Rightarrow n \quad [x' \mapsto n], \Lambda \vdash e' \Rightarrow n'}{\sigma, \Lambda \vdash \{x\ e\} \Rightarrow n'}$$