CS 312 Work Assignment 4

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1. (a) $E \vdash x$: less than 0
$\underline{E \vdash e_1 : e'}$
branch x $\{e_1 e_2 e_3\}$: e'

$E \vdash x : 0$
$\underline{E \vdash e_2 : e'}$
branch x $\{e_1 e_2 e_3\}$: e'

$E \vdash x$: greater than 0
$\underline{E \vdash e_3 : e'}$
branch x $\{e_1 e_2 e_3\}$: e'

(b) $\dfrac{< x, E > \rightarrow < x', E' > \quad < x' \text{ less than } 0, E' > \rightarrow < e_1, E' >}{<\text{branch } \{e_1\ e_2\ e_3\}, E' > \rightarrow <\text{e}_1, E' >}$

$\dfrac{< x, E > \rightarrow < x', E' > \quad < x' \text{ is } 0, E' > \rightarrow < e_2, E' >}{<\text{branch } \{e_1\ e_2\ e_3\}, E' > \rightarrow <\text{e}_2, E' >}$

$\dfrac{< x, E > \rightarrow < x', E' > \quad < x' \text{ greater than } 0, E' > \rightarrow < e_3, E' >}{<\text{branch } \{e_1 e_2 e_3\}, E' > \rightarrow <\text{e}_3, E' >}$

2. (a) $\underline{\vdash e_2[e_1/x] : e}$
$\vdash$ let x = e_1 in e_2: e

(b) $\dfrac{< e_2, E[x \leftarrow e_1] > \rightarrow < e_3, \_ >}{< \text{let x} = e_1 \text{ in } e_2, \text{E} > \rightarrow <\text{e}_3, E >}$

3. (a) 3*4
5/2
6/4 *2

(b) $\vdash S_1 : c_1$

$\dfrac{\vdash S_1 : c_1 \quad \vdash S_2 : c_2}{\vdash S_1 * S_2 : c_1 * c_2}$

$\vdash S_2 : c_2$ is not zero
$\underline{\vdash S_1 : c_1}$
$\vdash S_1 / S_2 : c_1 / c_2$

$$\frac{\vdash e_2[e_1/x] : e}{\vdash \text{let x = } e_1 \text{ in } e_2\text{: e}}$$