

(a)

$$\frac{[x \leftarrow 2] \vdash d_3 \xrightarrow{d}^* P_3}{[x \leftarrow 2] \vdash d_3; d_4 \xrightarrow{d} P_3; d_4} \mathcal{D}_4$$

$$[x \leftarrow 2] \vdash x+1 \rightarrow_e 3$$

 \mathcal{D}_3

$$[x \leftarrow 2] \vdash \text{const } y:\text{int}=x+1 \xrightarrow{d} [y \leftarrow 3]$$

 \mathcal{D}_4

$$[x \leftarrow 2] \vdash \text{const } y:\text{int}=x+1; \text{const } z:\text{int}=y+x \xrightarrow{d} [y \leftarrow 3]; \text{const } z:\text{int}=y+x$$

(b)

$$\frac{[x \leftarrow 2][P_3] \vdash d_4 \xrightarrow{d}^* P_4}{[x \leftarrow 2] \vdash P_3; d_4 \xrightarrow{d} P_3; P_4} \mathcal{D}_5$$

$$[x \leftarrow 2] \vdash P_3; P_4 \xrightarrow{d} P_3[P_4] \quad \mathcal{D}_6$$