

## Ex3 Theory

### 2.4

$$\frac{\Gamma \vdash_e e0 : \text{int} \quad \Gamma, (l, i : \text{int}) \vdash_e e1 : \text{bool} \quad \Gamma, (l, i : \text{int}) \vdash_s s1 \quad \Gamma, (l, i : \text{int}) \vdash_s s2}{\Gamma \vdash \text{for} (\text{int } i = e0; e1; s1) s2} \text{ (for)}$$

### 2.5

Derivation (We use  $\Gamma$  for  $(\text{return} : \text{int}[]), (l, y : \text{int}[])$ ) :

$$\frac{\frac{\frac{D2 \quad \text{int}[] \prec \text{int}[]}{\Gamma \vdash_s y = \text{new int}[2];} \text{ (assign)} \quad \frac{D3}{\Gamma \vdash_{sl} y[1] = 1; \text{return } y;} \text{ (seq)}}{(\text{return} : \text{int}[]), (l, y : \text{int}[]) \vdash_{sl} y = \text{new int}[2]; y[1] = 1; \text{return } y;} \text{ (seq)} \quad \frac{}{(\text{return} : \text{int}[]) \vdash_{sl} \text{int}[] y; y = \text{new int}[2]; y[1] = 1; \text{return } y;} \text{ (var - decl)}$$

D2:

$$\frac{(\_, y : \text{int}) \in \Gamma}{\Gamma \vdash_e y : \text{int}[]} \text{ (var - use)}$$

$$\frac{\frac{}{\Gamma \vdash_e 2 : \text{int}} \text{ (int - literal)}}{\Gamma \vdash_e \text{new int}[2] : \text{int}[]} \text{ (new - array)}$$

D3:

$$\frac{\frac{\frac{(\_, y : \text{int}[]) \in \Gamma}{\Gamma \vdash_e y : \text{int}[]} \text{ (var - use)} \quad \frac{}{\Gamma \vdash_e 1 : \text{int}} \text{ (int - literal)}}{\Gamma \vdash_e y[1] : \text{int}} \text{ (array - lookup)} \quad \frac{}{\Gamma \vdash_e 1 : \text{int}} \text{ (int - literal)}}{\Gamma \vdash_s y[1] = 1;} \text{ (assign)}$$

$$\frac{\frac{(\_, y : \text{int}[]) \in \Gamma}{\Gamma \vdash_s y : \text{int}[]} \text{ (var - use)} \quad \text{int}[] \in \text{int}[] \quad (\text{return} : \text{int}[]) \in \Gamma}{\Gamma \vdash_s \text{return } y;} \text{ (return)}$$