CS 456 Fall 2022 Project 1 Inference Rules

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The full list of inference rules for Heapy Imp in addition to the big step semantics already defined is below. Assume S stands for the set of statements. Assume $y \in Id$.

$$\frac{\Gamma(x) = T}{\Gamma \vdash x : T} \tag{T-Var}$$

$$\frac{}{\Gamma \vdash \text{true} : \text{bool}} \tag{T-True}$$

$$\frac{}{\Gamma \vdash \text{false} : \text{bool}} \tag{T-False}$$

$$\frac{}{\Gamma \vdash n : \text{nat}} \tag{T-Nat}$$

$$\frac{\Gamma \vdash e : \text{nat}}{\Gamma \vdash \text{new}(e) : \text{ptrnat}} \tag{E-NewNat}$$

$$\frac{\Gamma \vdash e_1 : \text{nat} \qquad \Gamma \vdash e_2 : \text{nat}}{\Gamma \vdash e_1 + e_2 : \text{nat}} \tag{E-Add}$$

$$\frac{\Gamma \vdash e_1 : \text{bool}}{\Gamma \vdash \neg e1 : \text{bool}} \tag{E-Neg}$$

$$\frac{\Gamma \vdash e_1 : \text{bool} \qquad \Gamma \vdash e_2 : \text{bool}}{\Gamma \vdash e_1 \wedge e_2 : \text{bool}} \tag{E-And}$$

$$\frac{\Gamma \vdash e_1 : \text{nat} \qquad \Gamma \vdash e_2 : \text{nat}}{\Gamma \vdash e_1 \leq e_2 : \text{bool}} \tag{E-LessEq}$$

$$\frac{\Gamma \vdash x : \text{ptrnat}}{\Gamma \vdash !x : \text{nat}} \tag{E-HeapReadNat}$$

$$\frac{\Gamma \vdash e : bool \qquad \Gamma \vdash s_1 : S \qquad \Gamma \vdash s_2 : S}{\Gamma \vdash \text{if } e \text{ then } s_1 \text{ else } s_2 : S} \qquad \text{(S-COND)}$$

$$\frac{\Gamma \vdash e : bool \qquad \Gamma \vdash s : S}{\Gamma \vdash \text{while } e \text{ do } s : S} \qquad \text{(S-LOOP)}$$

$$\frac{\Gamma \vdash s_1 : S \qquad \Gamma \vdash s_2 : S}{\Gamma \vdash s_1 ; s_2 : S} \qquad \text{(S-SEQ)}$$

$$\frac{\Gamma \vdash x : nat \qquad \Gamma \vdash e : nat}{\Gamma \vdash x := e : S} \qquad \text{(S-ASSIGNNAT)}$$

$$\frac{\Gamma \vdash x : bool \qquad \Gamma \vdash e : bool}{\Gamma \vdash x := e : S} \qquad \text{(S-ASSIGNBOOL)}$$

$$\frac{\Gamma \vdash x : ptrnat \qquad \Gamma \vdash e : nat}{\Gamma \vdash !x := e : S} \qquad \text{(S-UPDATEPTRNAT)}$$

$$\frac{\Gamma \vdash x : ptrnat \qquad \Gamma \vdash y : ptrnat}{\Gamma \vdash x = y : S} \qquad \text{(S-ALIASPTRNAT)}$$

$$\frac{\Gamma \vdash x : ptrnat \qquad \Gamma \vdash e : nat}{\Gamma \vdash x := \text{new}(e) : S} \qquad \text{(S-PUTNEWPTRNAT)}$$

$$\frac{}{\Gamma \vdash \text{skip} : S} \qquad \text{(S-SKIP)}$$