

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. S stands for statements.

$$\frac{n \in \mathbb{N}}{\Gamma \vdash n : \text{nat}} \quad (\text{T-NAT})$$

$$\frac{\Gamma(x) = \top}{\Gamma \vdash x : \top} \quad (\text{T-VAR})$$

$$\frac{}{\Gamma \vdash \text{true} : \text{bool}} \quad (\text{T-TRUE})$$

$$\frac{}{\Gamma \vdash \text{false} : \text{bool}} \quad (\text{T-FALSE})$$

$$\frac{e_1 \in \mathbb{N}}{\Gamma \vdash e_1 : \text{nat}} \quad (\text{T-NAT})$$

$$\frac{\Gamma \vdash n : \text{nat}}{\Gamma \vdash \text{new}(n) : \text{ptrnat_r}} \quad (\text{T-NEWNAT})$$

$$\frac{\Gamma \vdash e_1 : \text{nat} \quad \Gamma \vdash e_2 : \text{nat}}{\Gamma \vdash e_1 + e_2 : \text{nat}} \quad (\text{E-ADD})$$

$$\frac{\Gamma \vdash e_1 : \text{bool}}{\Gamma \vdash \neg e_1 : \text{bool}} \quad (\text{E-NEG})$$

$$\frac{\Gamma \vdash e_1 : \text{bool} \quad \Gamma \vdash e_2 : \text{bool}}{\Gamma \vdash e_1 \wedge e_2 : \text{bool}} \quad (\text{E-AND})$$

$$\frac{\Gamma \vdash e_1 : \text{nat} \quad \Gamma \vdash e_2 : \text{nat}}{\Gamma \vdash e_1 \leq e_2 : \text{bool}} \quad (\text{E-LESSEQ})$$

$\frac{\Gamma \vdash x : \text{ptrnat}}{\Gamma \vdash !x : \text{nat}}$	(E-HEAPREADNAT)
$\frac{\Gamma \vdash b_1 : \text{bool} \quad \Gamma \vdash s_1 : S \quad \Gamma \vdash s_2 : S}{\Gamma \vdash \text{if } b_1 \text{ then } s_1 \text{ else } s_2 : S}$	(S-COND)
$\frac{\Gamma \vdash b : \text{bool} \quad \Gamma \vdash s : S}{\Gamma \vdash \text{while } b \text{ do } s : S}$	(S-LOOP)
$\frac{\Gamma \vdash s_1 : S \quad \Gamma \vdash s_2 : S}{\Gamma \vdash s_1; s_2 : S}$	(S-SEQ)
$\frac{\Gamma \vdash x : \text{nat} \quad \Gamma \vdash e : \text{nat}}{\Gamma \vdash x := e : S}$	(S-ASSIGNNAT)
$\frac{\Gamma \vdash x : \text{bool} \quad \Gamma \vdash e : \text{bool}}{\Gamma \vdash x := e : S}$	(S-ASSIGNBOOL)
$\frac{\Gamma \vdash x : \text{ptrnat} \quad \Gamma \vdash e : \text{nat}}{\Gamma \vdash !x := e : S}$	(S-UPDATEPTRNAT)
$\frac{\Gamma \vdash x : \text{ptrnat} \quad \Gamma \vdash y : \text{ptrnat}}{\Gamma \vdash x = y : S}$	(S-ALIASPTRNAT)
$\frac{\Gamma \vdash x : \text{ptrnat} \quad \Gamma \vdash y : \text{ptrnat_r}}{\Gamma \vdash x = y : S}$	(S-ALIASPTRNAT_R)
$\frac{\Gamma \vdash x : \text{ptrnat} \quad \Gamma \vdash \text{new}(e) : \text{ptrnat_r}}{\Gamma \vdash x := \text{new}(e) : S}$	(S-PUTNEWPTRNAT)