

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:

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

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

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

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

$$\frac{t_1 \longrightarrow t_4}{\text{If } t_1 \text{ then } t_2 \text{ else } t_3 \longrightarrow \text{If } t_4 \text{ then } t_2 \text{ else } t_3} \quad (\text{E-IFAPP})$$

$$\frac{t_1 = \text{true}}{\text{If } t_1 \text{ then } t_2 \text{ else } t_3 \longrightarrow t_2} \quad (\text{E-CONDTRUE})$$

$$\frac{t_1 = \text{false}}{\text{If } t_1 \text{ then } t_2 \text{ else } t_3 \longrightarrow t_3} \quad (\text{E-CONDFALSE})$$

$$\frac{e_1 \longrightarrow e_3}{e_1 \wedge e_2 \longrightarrow e_3 \wedge e_2} \quad (\text{E-ANDAPP1})$$

$$\frac{e_2 \longrightarrow e_3}{e_1 \wedge e_2 \longrightarrow e_1 \wedge e_3} \quad (\text{E-ANDAPP2})$$

$$\frac{t_1 = \text{True} \quad t_2 = \text{True}}{t_1 \wedge t_2 \longrightarrow \text{True}} \quad (\text{E-APPANDT})$$

$$\frac{t_1 = \text{True} \quad t_2 = \text{False}}{e_1 \wedge e_2 \longrightarrow \text{False}} \quad (\text{E-APPANDF1})$$

$$\frac{t_1 = \text{False} \quad t_2 = \text{True}}{e_1 \wedge e_2 \longrightarrow \text{False}} \quad (\text{E-APPANDF2})$$

$$\frac{t_1 = \text{False} \quad t_2 = \text{False}}{e_1 \wedge e_2 \longrightarrow \text{False}} \quad (\text{E-APPANDF3})$$

$$\frac{e_1 \in \mathbb{N} \quad e_2 \in \mathbb{N}}{e1 + e2 \longrightarrow e_1 +_{\mathbb{N}} e_2} \quad (\text{E-ADDNAT})$$

$$\frac{e_1 \longrightarrow e_3}{e1 + e2 \longrightarrow e_3 + e_2} \quad (\text{E-ADDNATAPP1})$$

$$\frac{e_2 \longrightarrow e_3}{e1 + e2 \longrightarrow e_1 + e_3} \quad (\text{E-ADDNATAPP2})$$