

Question 1

inc (true) - - e is not specified as an int type

$$\text{[T-INC]} \quad \frac{}{inc\ e: Int}$$

Question 2

modified rules [t-IF] [t-TRUE] [t-FALSE]

$$\text{[T-INT]} \quad \frac{}{i: Int}$$

$$\text{[T-TRUE]} \quad \frac{}{true: Bool}$$

$$\text{[T-FALSE]} \quad \frac{}{false: Bool}$$

$$\text{[T-IF]} \quad \frac{e_1: Bool \quad e_2: T \quad e_3: T}{\text{if } e_1 \text{ then } e_2 \text{ else } e_3: T}$$

$$\text{[T-INC]} \quad \frac{e: Int}{inc\ e: Int}$$

$$\text{[T-DEC]} \quad \frac{e: Int}{dec\ e: Int}$$

Question 3

add rules [t-ISBOOL] [t-ISINT]

$$\text{[T-INT]} \quad \frac{}{i: Int}$$

$$\text{[T-TRUE]} \quad \frac{}{true: Bool}$$

$$\text{[T-FALSE]} \quad \frac{}{false: Bool}$$

$$\text{[T-IF]} \quad \frac{e_1: T_1 \quad e_2: T_2 \quad e_3: T_2}{\text{if } e_1 \text{ then } e_2 \text{ else } e_3: T_2}$$

$$\text{[T-INC]} \quad \frac{}{inc\ e: Int}$$

$$\text{[T-DEC]} \quad \frac{}{dec\ e: Int}$$

$$\text{[T-ISBOOL]} \quad \frac{e: Bool}{isbool\ e: Bool}$$

$$\text{[T-ISINT]} \quad \frac{e: Int}{isint\ e: Bool}$$