Problem 8:

Elimination Rules

$$\frac{\Gamma_\xi, \Gamma_\phi, \Gamma_e \vdash e : \text{LIST}(\tau)}{\Gamma_\xi, \Gamma_\phi, \Gamma_e \vdash \text{NULL}(e) : \text{bool}} \quad (\text{NULL})$$

$$\frac{\Gamma_\xi, \Gamma_\phi, \Gamma_e \vdash e : \text{LIST}(\tau)}{\Gamma_\xi, \Gamma_\phi, \Gamma_e \vdash \text{CAR}(e) : \tau} \quad (\text{CAR})$$

$$\frac{\Gamma_\xi, \Gamma_\phi, \Gamma_e \vdash e : \text{LIST}(\tau)}{\Gamma_\xi, \Gamma_\phi, \Gamma_e \vdash \text{CDR}(e) : \text{LIST}(\tau)} \quad (\text{CDR})$$

Formation Rule:

$$\frac{\tau \text{ is a type}}{\text{LIST}(\tau) \text{ is a type}} \quad (\text{List Formation})$$

Introduction Rules

$$\frac{\Gamma_\xi, \Gamma_\phi, \Gamma_e \vdash e_1 : \tau \quad \Gamma_\xi, \Gamma_\phi, \Gamma_e \vdash e_2 : \text{LIST}(\tau)}{\Gamma_\xi, \Gamma_\phi, \Gamma_e \vdash \text{CONS}(e_1, e_2)} \quad (\text{CONS})$$

$$\frac{}{\Gamma_\xi, \Gamma_\phi, \Gamma_e \vdash \text{NIL} : \text{LIST}(\tau)}$$

Abstract Syntax

```
| NULL  of exp list
| CAR   of exp list
| CDR   of exp list
| CONS  of exp * exp list
| NIL   of exp list
```