Part A

list type: formation rule

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

Cons: introduction rule

$$\frac{(\Gamma_{\mathcal{E},\phi,\rho} \vdash e_1 : \text{LIST}(\tau) \text{ or } e_1 : \tau) \text{ AND } (\Gamma_{\mathcal{E},\phi,\rho} \vdash e_2 : \text{LIST}(\tau) \text{ or } e_2 : \tau)}{\Gamma_{\mathcal{E},\phi,\rho} \vdash \text{CONS}(e_1, e_2) : \text{LIST}(\tau)} \quad (\text{LISTCONS})$$

car: elimination rule

$$\frac{\Gamma_{\mathcal{E},\phi,\rho} \vdash e : \text{LIST}(\tau)}{\Gamma_{\mathcal{E},\phi,\rho} \vdash \text{CAR}(e) : \tau} \quad (\text{CAR})$$

cdr: elimination rule

$$\frac{\Gamma_{\mathcal{E},\phi,\rho} \vdash e : \text{LIST}(\tau)}{\Gamma_{\mathcal{E},\phi,\rho} \vdash \text{CDR}(e) : \text{LIST}(\tau)} \quad (\text{CDR})$$

null?: elimination rule

$$\frac{\Gamma_{\mathcal{E},\phi,\rho} \vdash \text{LIST}(\tau)}{\Gamma_{\mathcal{E},\phi,\rho} \vdash \text{NULL?}(e) : \text{BOOL}} \quad (\text{NULL})$$

empty-list introduction rule

$$\frac{\tau \text{ is a type}}{\Gamma_{\mathcal{E},\phi,\rho} \vdash \text{MAKE-EMPTY}(\tau) : \text{LIST}(\tau)} \quad (\text{MAKEEMPTYLIST})$$