# Homework #11

## CS320, Fall 2017

Student id: _____    Name: _____

Given the following grammar:

$$e ::= \quad \dots$$
$$| \quad \texttt{\{throw\}}$$
$$| \quad \texttt{\{try } e \texttt{ catch } e\texttt{\}}$$
$$| \quad \texttt{\{withtype \{}t \texttt{ \{}x\ \tau\texttt{\} \{}x\ \tau\texttt{\}\} } e\texttt{\}}$$
$$| \quad \texttt{\{cases } t\ e \texttt{ \{}x\texttt{ \{}x\texttt{\} } e\texttt{\} \{}x \texttt{ \{}x\texttt{ \} } e\texttt{\}\}}$$
$$\tau ::= \quad \dots$$
$$| \quad t$$
$$| \quad \texttt{anyT}$$

a) Write the operational semantics of the form $\boxed{\sigma \vdash e \Rightarrow v}$ for the expressions.

b) Write the typing rules for the expressions.

c) Draw the type derivation of the following expression:

```
{withtype {fruit {apple num} {banana (bool -> num)}}
         {cases fruit {banana {fun {x:num} 3}}
            {apple  {n} n}
            {banana {f} {f true}}}}
```