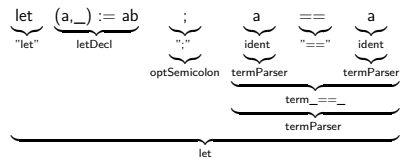
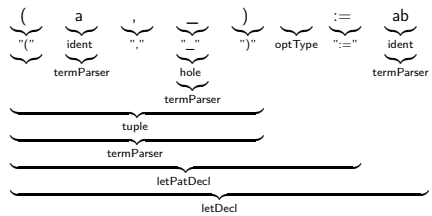
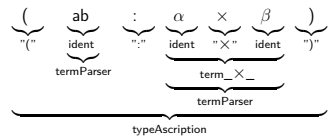
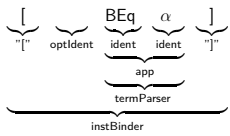
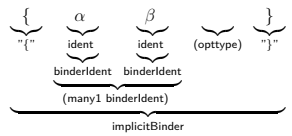
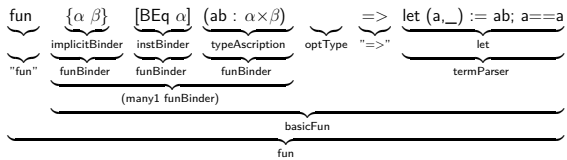


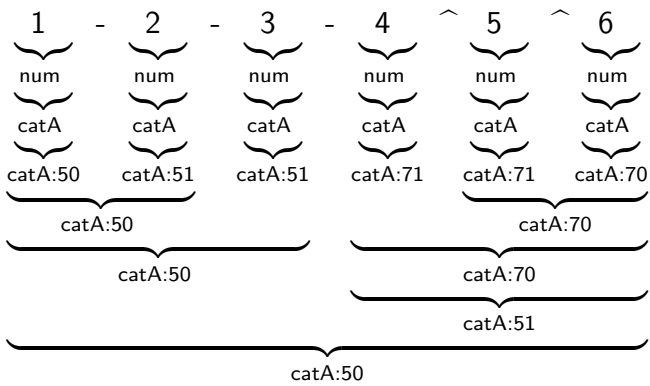
# Some type inferences and parsing diagrams

Eduardo Ochs - RCN/PURO/UFF

<http://anggtwu.net/eev-lean4.html>

$$\begin{array}{c}
 \text{bind } \underbrace{[a_1, a_2]}_{: \text{List A}} \text{ fun } \underbrace{a}_{: A} \Rightarrow \text{bind } \underbrace{[b_1, b_2]}_{: \text{List B}} \text{ fun } \underbrace{b}_{: B} \Rightarrow \text{pure } \left( \underbrace{\underbrace{a}_{: A}, \underbrace{b}_{: B}}_{: A \times B} \right) \\
 \underbrace{\hspace{15em}}_{: \text{List } A \times B} \\
 \underbrace{\hspace{10em}}_{: B \rightarrow \text{List } A \times B} \\
 \underbrace{\hspace{5em}}_{: \text{List } A \times B} \\
 \underbrace{\hspace{2em}}_{: A \rightarrow \text{List } A \times B} \\
 \underbrace{\hspace{1em}}_{: \text{List } A \times B}
 \end{array}$$





```

newtype ST a = S (State -> (a,State))
app :: ST a -> State -> (a,State)
app (S st) x = st x

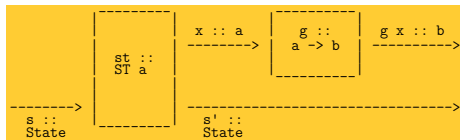
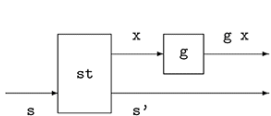
```

$$\underbrace{\underbrace{\underbrace{\underbrace{\text{app (S st)}}_{::\text{S}(\text{State} \rightarrow (\text{a}, \text{State}))}}_{::\text{ST a}}} \underbrace{\underbrace{\text{x}}_{::\text{State}}}_{::(\text{a}, \text{State})}}_{::(\text{a}, \text{State})} = \underbrace{\underbrace{\underbrace{\text{st}}_{::\text{State} \rightarrow (\text{a}, \text{State})}} \underbrace{\text{x}}_{::\text{State}}}_{::(\text{a}, \text{State})}$$

```

newtype ST a = S (State -> (a,State))
app :: ST a -> State -> (a,State)
app (S st) x = st x
instance Functor ST where
  -- fmap :: (a -> b) -> ST a -> ST b
  fmap g st = S (\s -> let (x,s') = app st s in (g x, s'))

```



$$\underbrace{\underbrace{\text{fmap } g}_{::a \rightarrow b} \underbrace{st}_{::ST\ a}}_{::ST\ b} = S (\underbrace{\underbrace{s}_{::State}}_{::State} \rightarrow \underbrace{\underbrace{\text{let } (x, s') = \underbrace{\text{app } st}_{::ST\ a} \underbrace{s}_{::State} \text{ in } (g \underbrace{x}_{::a}, \underbrace{s'}_{::State})}_{::(a, State)}}_{::(a, State)})$$