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6.1120 Fall 2025

Miniquiz #11

5 Minutes

1. Consider the extension to IMP that we saw last lecture, which added block scopes to the language. Suppose we redefine variable declarations as follows, with changes highlighted in bold (where $\cdot$ denotes the empty stack):

$$\frac{\neg(x \in \text{visible}(\gamma :: \sigma)) \quad (\gamma :: \sigma, h, e) \rightarrow v \quad \neg(a \in \text{dom}(h)) \quad \sigma[x:a] = \sigma' \quad h[a:v] = h'}{(\gamma :: \sigma, h, \text{var } x = e) \rightarrow (\gamma :: \sigma', h')}$$

$$\frac{\text{dom}(\sigma) = d}{\text{visible}(\cdot :: \sigma) = d} \quad \frac{\text{visible}(\gamma) = d_1 \quad \text{dom}(\sigma) = d_2 \quad d_1 \cup d_2 = d}{\text{visible}(\gamma :: \sigma) = d}$$

In plain English, how does this modification change the semantics of variable declarations?

2. What is the output of each program below?

```
var g = 3;
var x = 2;
var f = fun(x) {
  var g = fun(y) {
    return x * y;
  }
  return g(4);
}
print(f(g));
```

Output: _____

```
var g = fun() {
  var x = 0;
  var f = fun() {
    x = x + 1;
    return x;
  };
  return f;
};
var a = g();
var b = g();
a();
a();
print(b());
```

Output: _____