

Problem 1

a)

`x = 45`

`const g = (x) => 12`

`g(10)`

`print x`

In the case of dynamic scoping, this would return 12, as `g` maps `x` to 12. In the case of static scoping, this would return 45 because all instances of `x` would be substituted with 45.

Problem 3

The evaluation is deterministic as the Search rules evaluate `e1` before `e2` in all cases. Values are not returned until the Do rules.

Problem 4

The expression `e1 + e2` will first hit the SearchBinary rule to evaluate `e1` to a value before evaluating `e2`. In order to change the evaluation order, we would need to change the SearchBinary rule to evaluate `e2` first. After both expressions have been evaluated the `doArith` rule is executed.

Problem 5

a)

Consider the expression `e1 && e2`. If we evaluate `e1` to value `v1` and if `toBoolean(v1) == false`, we know the expression should return false. This short-circuit evaluation means that we never have to evaluate `e2`.

b)

According to the figure's small step operational semantics, `e1 && e2` will short circuit by the SearchBinary and DoAndFalse rules. According to SearchBinary, `e1` is evaluated first and by DoAndFalse, if `e1` is evaluated to `v1` and if `toBoolean(v1) == false`, the evaluation will short circuit and return `v1`.