

# River Kelly

CSCI-305: Concepts/Programming Languages

Chapter-5 Homework

Due: February 22, 2021

1. Dynamic type binding is closely related to implicit heap-dynamic variables. Explain this relationship.

- Allocation and Deallocation happen upon variable assignment.
- In both, the type of the variable is bound upon assignment of a value at run-time.
- Very hard, or almost impossible to implement error-detection. (Because type is not assigned until run-time, it is possible to use incorrect type on right side assignment)
- Because type is assigned dynamically, they both offer very high levels of flexibility.

2. Consider the following JavaScript skeletal program:

<pre>// The main program var x; function sub1() {   var x;   function sub2() {     . . .   } } function sub3() {   . . . }</pre>	<p>Assume that the execution of this program is in the following unit order:</p> <p>main calls sub1</p> <p>sub1 calls sub2</p> <p>sub2 calls sub3</p>
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a. Assuming static scoping, in the following, which declaration of x is the correct one for a reference to x?

- i. sub1 - local x (of sub1)
- ii. sub2 - nonlocal x (of sub1)
- iii. sub3 - nonlocal x (of main)

b. Repeat part a, but assume dynamic scoping.

**Note:** Dynamic scoping is based on the calling sequence of subprograms, not on their spatial relationship to each other. In this case, the search proceeds from the local procedure, to its caller.

- i. sub1 - local x (of sub1)
- ii. sub2 - nonlocal x (of sub1)
- iii. sub3 - nonlocal x (of sub1)

3. Consider the following JavaScript program:

```
var x, y, z;
function sub1() {
    var a, y, z;
    function sub2() {
        var a, b, z;
        . . .
    }
    . . .
}
function sub3() {
    var a, x, w;
    . . .
}
```

List all the variables, along with the program units where they are declared, that are visible in the bodies of sub1 , sub2 , and sub3 , assuming static scoping is used.

- sub1
  - local a (of sub1)
  - local y (of sub1)
  - local z (of sub1)
  - global x for reference and for assignment
  - Technically not a variable, but sub2, a function, is also only locally accessible from sub1
- sub2
  - local a (of sub2)
  - local b (of sub2)
  - local z (of sub2)
  - nonlocal y (of sub1)
  - global x for reference and for assignment
- sub3
  - local a (of sub3)
  - local x (of sub3)
  - local w (of sub3)
  - global y reference and for assignment
  - global z reference and for assignment