

# CSCI 485 Programming Languages

## Assignment 5

Due Friday, February 26

1. Some programming languages are typeless. What are the obvious advantages and disadvantages of having no types in a language?
2. Consider the following Python program:

```
x = 1;
y = 3;
z = 5;
def sub1():
    a = 7;
    y = 9;
    z = 11;
    ...

def sub2():
    global x;
    a = 13;
    x = 15;
    w = 17;
    ...

def sub3():
    nonlocal a;
    a = 19;
    b = 21;
    z = 23;
    ...

...
```

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.

3. Consider the following SML program:

```
val a = 3
val b = 2 + 3
val c = a < b
val d = 5 - 3
val e = (3 + 3) - (4 + 3)
val f = if c then a else b
```

answer the following questions,

- 
- (a) Using the above program as an example, explain what a binding is.
  - (b) Does every expression evaluate to a value? Support your answer.
  - (c) What is the syntax rule for a less-than comparison?
  - (d) What is the type checking rule for a less-than comparison?
  - (e) Explain what a static environment is and what a dynamic environment is. Give an example to support your answer using the above SML program.