HW11  Due Monday Oct 12  20 points

1) Some programming languages are typeless. What are the obvious advantages and disadvantages of having no types in a language?

The advantage of a typeless language is flexibility; any variable can be used for any type values. The disadvantage is poor reliability due to the ease with which type errors can be made, coupled with the impossibility of type checking detecting them.

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

Implicit heap-dynamic variables acquire types only when assigned values, which must be at runtime. Therefore, these variables are always dynamically bound to types.

Consider the following JavaScript skeletal program:

```javascript
// The main program
var x;
function sub1() {
    var x;
    function sub2() {
        ...
    }
    function sub3() {
        ...
    }
}
main calls sub1
sub1 calls sub2
sub2 calls sub3
```
a. Assuming static scoping, in the following, which declaration of \( x \) is the correct one for a reference to \( x \)?

i. sub1

ii. sub2

iii. sub3

b. Repeat part a, but assume dynamic scoping.

(a) i. sub1

ii. sub1

iii. main

(b) i. sub1

ii. sub1

iii. sub1
7. Assume the following JavaScript program was interpreted using static-scoping rules. What value of x is displayed in function sub1?

Under dynamic-scoping rules, what value of x is displayed in function sub1?

```
var x;
function sub1() {
    document.write("x = " + x + ");
}
function sub2() {
    var x;
    x = 10;
    sub1();
}
x = 5;
sub2();
```

**Static scoping:** x is 5

**Dynamic scoping:** x is 10