# Homework 4

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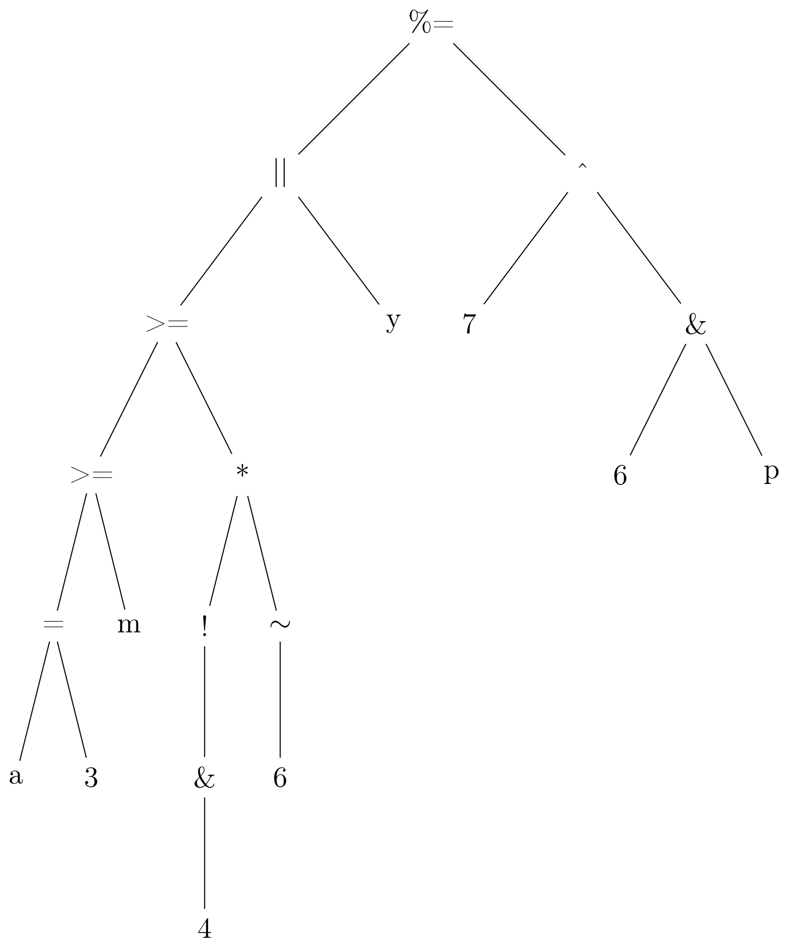
## 1 Abstract Syntax Tree

(a = 3) >= m >= ! & 4 * ˜6 || y %= 7 ˆ 6 & p



## 2 Javascript semicolon questions

### 2.a

When trying to call the function f(), it returns undefined. Javascript inserts semicolons into the program as so:

```
function f() {
    return;
    {x: 5};
}
```

Python would remedy this because one would receive an indentation error trying to run the Python equivalent of code.

### 2.b

When trying to evaluate this expression, we receive this error TypeError: Property 'b' of object #<Object> is not a function. Javascript inserts semicolons into the program and interprets it as so:

```
var b = 8;
var a = b + b(4 + 5).toString(16);
```

Python would remedy this because the lexical definition of statements says that logical lines end in with a newline.

### 2.c

After trying to evaluate the program, we receive this error, TypeError: 'undefined' is not an object (evaluating '"mundo" ["Hola", "Ciao"].forEach'). This is because it is attempting to use the ["Hola", "Ciao"] as indexer operator to "mundo". Again, Python would remedy this because the lexical definition of statements say that logical lines end in with a newline.

### 2.d

When trying to evaluate this, we are alerted with "Goodbye" then "Hello". This is because sayHello is called with the anonymous function below due to being in a closure. Javascript interprets the code as this:

```
var sayHello = function () {
    console.log("Hello")
}

(function() {
    console.log("Goodbye")
}(sayHello))
```

## 3 What if local variables were allocated in static storage?

Consider this code:

```c
#include <stdio.h>

int f(int x) {
    int a = 0;
    if (x == 0) {
        a = 1;
    } else {
        return f(x - x) + a;
    }
    return 0;
}

int main() {
    printf("%d\n", f(5));
    return 0;
}
```

The program prints out 0. If local variables were allowed in static storage, the program would print out 1.

## 4 Scoping

### 4.a Static Scoping

It would print out 1122 since the second setX() call changes the global variable to 2.

### 4.b Dynamic Scoping

It would print out 1121 since the second setX() call only changes the local variable x.

## 5 Binding within dynamic scoping

Consider this python code:

```python
a = 4
b = 0
c = 7
d = 7

def f(n):
    global a
    a = n
    return a

```

```python
print (a - f(b) - c * d)
```

If Python were to evaluate the the function first which would assign the global a to 0, then the expression could yield different results. If the lookup for a were to happen first, then a would stay as 4.

## 6 Explain the C declarations

### 6.a double *a[n];

This is an array of n pointers to doubles.

### 6.b double (*b)[n];

This is a pointer to an array of n doubles.

### 6.c double (*c[n])();

This is an array of n pointers pointing to functions returning a double.

### 6.d double (*d())[n];

This is a function returning a pointer to an array of n doubles.

## 7 Rewrite problem 6 in Go

### 7.a var a [n]*float64

### 7.b var b (*)[n]float64

### 7.c var c [n] *func()float64

### 7.d var d func() (*[n]float64)

## 8 Convert from infix (-b + sqrt(4 × a × c)) / (2 × a)

### 8.a Postfix

0 b - c 4 a ×× sqrt + 2 a × /

### 8.b Prefix

/ × 2 a + - 0 b sqrt ×× 4 a c

### 8.c Do you need a special symbol for unary negation? Why or why not?

There are two options. If you make parentheses required, you must assign another symbol for unary negation like ~. If you don't make them required, you can simply subtract from 0.

## 9 Interleave using C-Style arrays

Code available at `http://codepad.org/Fw4xASrh` and on my github.

```cpp
#include <iostream>
using namespace std;

void interleave(int a[], int lena, int b[], int lenb, int c[]) {
    int aindex = 0;
    int bindex = 0;

    for (int i = 0; i < (lena + lenb); ) {
        if (aindex < lena) {
            c[i] = a[aindex];
            aindex++;
            i++;
        }

        if (bindex < lenb) {
            c[i] = b[bindex];
            bindex++;
            i++;
        }
    }
}

int main () {

    int a[50], b[50], c[100], lena, lenb, lenc, i;

    cout << "Input number of elements in first array\n";
    scanf("%d", &lena);

    cout << "Input " << lena << " integers\n";
    for (i = 0; i < lena; i++) {
        scanf("%d", &a[i]);
    }

    cout << "Input number of elements in second array\n";
    scanf("%d", &lenb);

    cout << "Input " << lenb << " integers\n";
    for (i = 0; i < lenb; i++) {
        scanf("%d", &b[i]);
    }

    interleave(a, lena, b, lenb, c);
    lenc = lena + lenb;

    for (int i = 0; i < lenc; i++) {
        cout << c[i] << " ";
    }
    cout << endl;

    return 0;
}
```

## 10 Interleave using C++ vectors

Code available at `http://codepad.org/P6KKMBqY` and on my github.

```
#include <iostream>
#include <vector>
using namespace std;

template <typename T>
vector <T> zip(const vector <T> & a, const vector <T> & b, size_t len) {
    vector <T> result;
    int aindex = 0;
    int bindex = 0;

    for (size_t i = 0; i < len; ) {
        if (aindex < a.size()) {
            result.push_back(a[aindex]);
            aindex++;
            i++;
        }

        if (bindex < b.size()) {
            result.push_back(b[bindex]);
            bindex++;
            i++;
        }
    }
    return result;
}

int main() {
    vector <int> a = {};
    vector <int> b = {};
    size_t lenc;
    int i, n, m, lena, lenb;

    cout << "Input number of elements in first array" << endl;
    scanf("%d", &lena);

    cout << "Input " << lena << " integers" << endl;
    for (i = 0; i < lena; i++) {
        scanf("%d", &n);
        a.push_back(n);
    }

    cout << "Input number of elements in second array" << endl;
    scanf("%d", &lenb);

    cout << "Input " << lenb << " integers" << endl;
    for (i = 0; i < lenb; i++) {
        scanf("%d", &m);
        b.push_back(m);
    }

    len = (a.size() + b.size());
    vector <int> c = zip(a, b, lenc);
    for(size_t i = 0; i < c.size(); i++) {
        cout << c[i] << " ";
    }
    cout << endl;
}
```