HW8

1) Multidimensional arrays can be stored in row major order, as in C++, or in column major order, as in Fortran. Develop the access functions for both of these arrangements for three-dimensional arrays.

Let the subscript ranges of the three dimensions be named \(min(1), min(2), min(3), max(1), max(2),\) and \(max(3)\). Let the sizes of the subscript ranges be \(size(1), size(2),\) and \(size(3)\). Assume the element size is 1.

**Row Major Order:**

\[
\text{location}(a[i,j,k]) = (\text{address of } a[\min(1),\min(2),\min(3)]) + ((i-\min(1))*size(3) + (j-\min(2))*size(2) + (k-\min(3))
\]

**Column Major Order:**

\[
\text{location}(a[i,j,k]) = (\text{address of } a[\min(1),\min(2),\min(3)]) + ((k-\min(3))*size(1) + (j-\min(2))*size(2) + (i-\min(1))
\]

2) In what way is static type checking better than dynamic type checking?

Static type checking is better than dynamic type checking for two reasons: First, anything done at compile time leads to better overall efficiency, simply because production programs are often executed but far less often compiled. Second, type checking uncovers program errors, and the earlier errors are found the less costly it is to remove them.

3) Describe a situation in which the add operator in a programming language would not be commutative.

An expression such as \(a + \text{fun}(&b),\)

4) Consider the following C program:

```c
int fun(int *i) {
    *i += 5;
    return 4;
}

void main() {
    int x = 3;
    x = x + fun(&x);
}
```
What is the value of $x$ after the assignment statement in main, assuming

a) operands are evaluated left to right.
b) operands are evaluated right to left.

(a) 7
(b) 12