

# CSC 455 - Project 1

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## 1 Question 1

The rule,  $\langle A \rangle \rightarrow \langle A \rangle + \langle A \rangle$ , could expand into the statement  $a = a + b + c$ , with no way to accurately reverse it. The resulting statement could, for example, be the result of  $a = \langle A \rangle + b + c$  or  $a = a + b + \langle A \rangle$ , as well as numerous other predecessors.

## 2 Question 2

### 2.1 Time Efficiency

The task was to measure performance when accessing a 2D Array in C using subscripting and using pointers and pointer arithmetic. The array utilized contained 100 million integers, and for each loop simply assigned a value to each cell.

The developed solution had the following execution results, with time measured in microseconds:

Run #	Subscripting	Pointers
1	407942	8
2	406256	10
3	403222	10
4	402273	7
5	406751	7
6	405312	7
7	406877	7

Accessing array data through pointers is clearly faster in this solution.

### 2.2 Reliability

However, the pointer arithmetic should be considered more unreliable than using array subscripting. Utilizing subscripting makes the code more readable as it gives an easy picture of which cell is being used. Pointer arithmetic is also not bounded, and could result in attempts to access memory outside of the array.

### 3 Question 3

#### 3.1 a

3. Semantic Rule:  $\langle expr \rangle .actual\_type \leftarrow$  if  $(\langle expr \rangle .actual\_type = int)$  and  
 $(\langle var \rangle .actual\_type = int)$   
then int  
else real  
end if

#### 3.2 b

### 4 Question 4

Static Scoping:  $x = 5$

Dynamic Scoping:  $x = 10$

## 5 Question 5

### 1. Point 1

- a - definition 1
- b - definition 2
- c - definition 2
- d - definition 2

### 2. Point 2

- a - definition 1
- b - definition 2
- c - definition 3
- d - definition 3
- e - definition 3

### 3. Point 3

- a - definition 1
- b - definition 2
- c - definition 2
- d - definition 2

### 4. Point 4

- a - definition 1
- b - definition 1
- c - definition 1