CS 442/542

• Compiling Arrays
int num1;
int num2;
int i;
int num3[11];
num1 = 10 + 2;
num2 = 20 * 3 + num1;
i = 7;
um3[i] = 500;
num1 = num2 + num3[i] * 10;
print num1;
print num2;
print num3[i];
Compiling Arrays

• Add a production to the grammar for array declarations

• Add a production so the left hand side of an assignment statement can be an array element reference

• Add a production so an array element reference can be used in an expression
Compiling Arrays

• Keep an attribute in the symbol table that indicates the size of the array.
• Use this information to generate a directive to allocate space for the array.
• This works for global arrays

    num3: .space 44
Compiling Arrays

Example Assembler Code for Array Assignment

Example Assignment statement: num3[i] = 500;

li $t2, 500
lw $t1, i
la $t3, num3
sll $t1, $t1, 2
add $t3, $t3, $t1
sw $t2, 0($t3)
Example Assembler Code using an array element in an expression

Example statement: num1 = num2+num3[i] * 10;

```
lw    $t4, num2
lw    $t5, i
la    $t6, num3
sll   $t5, $t5, 2
add   $t6, $t6, $t5
lw    $t6, 0($t6)
li    $t7, 10
mul   $t8, $t6, $t7
add   $t6, $t4, $t8
sw    $t6, num1
```
i = 0;
while ( i < 10) {
    j = 0;
    while (j < 10-i) {
        if (num3[j] > num3[j+1]) {
            temp = num3[j];
            num3[j] = num3[j+1];
            num3[j+1] = temp;
        }
        j= j+1;
    }
    i = i+1;
}
Compiling Arrays: Bubble Sort

L3:
li   $t0, 0
sw   $t0, i

L9:
lw   $t0, i
li   $t1, 10
bge  $t0, $t1, L5
li   $t0, 0
sw   $t0, j

L8:
lw   $t0, j
li   $t1, 10
lw   $t2, i
sub  $t3, $t1, $t2
bge  $t0, $t3, L6
Compiling Arrays: Bubble Sort

lw $t0, j
la $t1, num3
sll $t0, $t0, 2
add $t1, $t1, $t0
lw $t1, 0($t1)
lw $t0, j
li $t2, 1
add $t3, $t0, $t2
la $t0, num3
sll $t3, $t3, 2
add $t0, $t0, $t3
lw $t0, 0($t0)
ble $t1, $t0, L7
Compiling Arrays: Bubble Sort

lw  $t0, j
la  $t1, num3
sll $t0, $t0, 2
add $t1, $t1, $t0
lw  $t1, 0($t1)
sw  $t1, temp
lw  $t0, j
lw  $t1, j
li  $t2, 1
add $t3, $t1, $t2
la  $t1, num3
sll $t3, $t3, 2
add $t1, $t1, $t3
lw  $t1, 0($t1)
la  $t2, num3
sll $t0, $t0, 2
add $t2, $t2, $t0
sw  $t1, 0($t2)
Compiling Arrays: Bubble Sort

lw  $t0, j
li  $t1, 1
add $t2, $t0, $t1
lw  $t0, temp
la  $t1, num3
sll $t2, $t2, 2
add $t1, $t1, $t2
sw  $t0, 0($t1)

L7:
  lw  $t0, j
  li  $t1, 1
  add $t2, $t0, $t1
  sw  $t2, j
  b   L8

L6:
  lw  $t0, i
  li  $t1, 1
  add $t2, $t0, $t1
  sw  $t2, i
  b   L9

L5: