CS 111
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Variables

Think:
When we have a class of 50 students, we’d like to store 50 names and 50 grades, how many variables do we have to declare?

string name1, name2, name3, ... , name50;
double grade1, grade2, grade3, ... , grade50;
Array

- A collection of similar data of same datatype
- We give the entire collection a name
- Each value in the collection is specified by an position, the position start from 0

**Ex:** one array to store all names, another array to store all grades

**Ex:** 5 student names

<table>
<thead>
<tr>
<th>Mary</th>
<th>Amy</th>
<th>John</th>
<th>Michael</th>
<th>Fred</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mary</td>
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<td>Fred</td>
</tr>
</tbody>
</table>

How do we declare and access array?

**Model:**

```java
array_datatype array_name [array_capacity];
Ex: string names[5];
```
Access Array

- We can only access one entry of the array at a time
- Must specify, array_name and position/index

Model: array_name[pos];

Ex:
double grades[7];

```plaintext
90  80  98  67  75  61  70
0   1   2   3   4   5   6
```

// set first entry value in array grades to 90
grades[0] = 90;

// print last entry value in array grades
cout << grades[6];

// print all values in array grades
x
cout << grades;
```
cout << grades[0] << grades[1] << … << grades[6];
only ONE entry can be accessed at a time.
- specify the index/position of this element in the array

double grades[10]; ← declaration
grades[0]; grades[1]; grades[2]; ... grades[9];

grades[ index ]
index is an integer from 0 – capacity - 1

How to print all entries in the array?
for (int i = 0; i < 10; i++){
    cout << grades[i] << " ";
}
cout << endl;
Sometime we would like to initialize the array like what we do with our single variables:

```
int x = 10;
int lookup[5] = {100, 90, 80, 70, 60};
```

- Use `{ }` to specify each entry values, each value separate by a `,`

Special case: Initialize all to zero

```
int sum[10] = {0};
```

`{0}` is a special code, `{1}` or others won’t work!
Program

//Read-in 10 students’ name and their grades
//find out the average
#include <iostream>
using namespace std;
int main(){
    string names[10];
    double grades[10];
    double sum = 0, avg;
    for (int sp = 0; sp < 10; sp++) {
        //pos always starts at 0
        //student counting at 1
        cout << “Please enter student #” << sp + 1;
        cin >> names[sp] >> grades[sp];
        sum = sum + grades[sp];
    }
    //average is total / count
    avg = sum / 10;
    return 0;
}
Program 2

// Read-in 10 students’ name and their grades
// Print the student’s name who got highest grade

int main()
{
    string names[10];
    double grades[10];
    double highest_grade = 0;
    for (int sp = 0; sp < 10; sp++) {
        cout << "Please enter student #" << sp + 1;
        cin >> names[sp] >> grades[sp];
    }
    for (int i = 0; i < 10; i++){
        if (grades[i] > highest_grade)
            highest_grade = grades[i];
    }
    for (int i = 0; i < 10; i++){
        if (grades[i] == highest_grade)
            cout << names[i] << ",";
    }
    cout << endl;
    return 0;
}

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>names</td>
<td>76</td>
<td>98</td>
<td>78</td>
<td>78</td>
<td>62</td>
<td>67</td>
<td>78</td>
<td>98</td>
<td>47</td>
<td>98</td>
</tr>
</tbody>
</table>
Program 3

// generate 100 random single digits
// print out how many times each digit have been generated
srand(time(0));
int num[100];
int count[10] = {0};
for (int i = 0; i < 100; i++) {
    num[i] = rand() % 10;
}

// go through all numbers again
for (int i = 0; i < 100; i++){
    int v = num[i];
    count[ v ]++;
}  // count[num[i]]++

// print all counts
for (int i = 0; i < 10; i++){
    cout << "count " << i << " : " << count[i] << endl;
}