One dimensional array

array : a collection of variables having the same data type and referred to by the same name

1. Array declaration: **data-type array-name[array-size];**

positive integer constant

```
float   scores[5];          int     intValues[1000];
char    name[15];           bool    vacation[365];
```

- specify the size of the array by using constant int declaration

```
const int ARRAY_SIZE = 10;
int intArray[ARRAY_SIZE];
```

2. Array subscript: access individual elements of an array

- array subscript starts with 0, ends with (specified array size – 1)

Assign the values to the10 elements of the array IntArray

```
intArray[0]=3;
intArray[1]=10;
…
intArray[8]=25;
intArray[9]=-14;
```

Example: Operation with array elements

```
int  sum= intArray[3]+intArray[5];
cin >> intArray[0];
cout << intArray[0];
if (sqrt(intArray[4]) >= 3)   {
        cout << intArray[4] << endl;
}
```

- subscript of array can be constant, expression, or variable. It has to evaluate to an integer

```
int x=1;
intArray[2*3]= 53;
intArray [x] = 24;
intArray [x+4] = 94;
```

- Array reference error occurs when reference to or access array element with array subscription out of the specified array boundary: 0 … (ARRAY_SIZE – 1)
  C++ does not perform array boundary check. Program contains array reference error may not get compilation error, but will have run time error (memory violation)

```
intArray[10] = intArray[30] + intArray[3];
```

3. Assign values to array elements during declaration

Example

```
const int ARRAY_SIZE = 10;
int   intArray[ARRAY_SIZE]={2, 3, 4, 5, 10, -9, -2, 0, 1, 3};
```

- Number of items in initialization list > array size specified → compilation error or warning

- Number of items in initialization list < array size specified → values of the rest of the elements are not determined, no compilation error

Example

```
const int ARRAY_SIZE = 10;
int    intArray[ARRAY_SIZE]={0};  ← this initializes all elements of the array to 0
```

Example

```
int intArray[] = {3, 5, 7, 9};
```

4. for loop

```
for (loop initialization ;    loop condition ;  loop updation)  {
        loop body;
}
```

Examples:

1) display the first 100 natural numbers

```
int   i;
for ( i=0;  i<100; i++)  {
    cout << i << endl;
}
```

2) display the lower case alphabetical letters

```
int   i;
for ( i=0;  i<26; i++)  {
    cout << char('a'+i) << endl;
}
```

5. Array iteration

(a)

```
const int ARRAY_SIZE = 15;
int     intValues[ARRAY_SIZE];
int i;

for (i=0; i<ARRAY_SIZE; i++) {
   intValues[i] = i*i + 1;
}
```

```
for (i=0; i<ARRAY_SIZE; i++)  {
        cout << "Please enter an integer:  ";
        cin >> intValues[i];
 }
```

(b)

```
for (i=0; i<ARRAY_SIZE; i++)
{
        cout << "value " << i+1 << ":" << intValues[i] << endl;
}
```

(c)

```
sum=0;
for (i=0; i<ARRAY_SIZE; i++)
{
        sum = sum + intValues[i];
}
average = (float)sum/ARRAY_SIZE;
```

5. Passing array to function as parameter

- array is always passed to function by reference
- there is no need to put **&**
- if the content of the array is not to be modified in the function, pass the array as a constant parameter

Examples:

1. Write a function "CountFreezingDays" that counts the number of days below freezing in a year, assuming an array with 365 values is passed into this function. (how to protect the data in array "temperature" such that no data will be accidentally changed in the function)

```
int  CountFreezingDays (float temperatures[], int numberOfDays)   {

            int count = 0;
            for (int i=0; i<numOfDays; i++)  {
               if (temperatures[i] <= 32)   {
                  count ++;
               }
   }

            return count;
}
```

2. Write a function that finds the coldest day temperature of the year
3. Write a function that computes the average temperature of the year.

4. Write a function that will compute the number of appearance, i.e., the frequency, of each digit in a sequence of digits entered.

```
void ComputeFrequency(string  sequence, int frequency[],  int size) {

   // initialize the frequency values
    for (int i=0; i<10; i++)  {
            frequency[i] = 0;
   }

   // compute the frequency of each digit
   for (int i=0; i<sequence.length(); i++)  {
            frequency[sequence[i]-'0'] ++;
    }
}
```

5. Display the frequency in table form

```
void DisplayFrequency(int frequency[], int size)  {
    for (int i=0; i<10; i++)  {
            cout << char('0'+i) << " : " << frequency[i]  << endl;
   }
}
```

6. Write a function "PickFortune" that randomly selects a fortune reading from a number of pre-stored readings. Assume an array of 100 readings (each of string type) is passed into the function as a parameter.
7. Write a function "CompareGrades" that compares the grades of two students to see if they make the same grades for each of the ten tests.