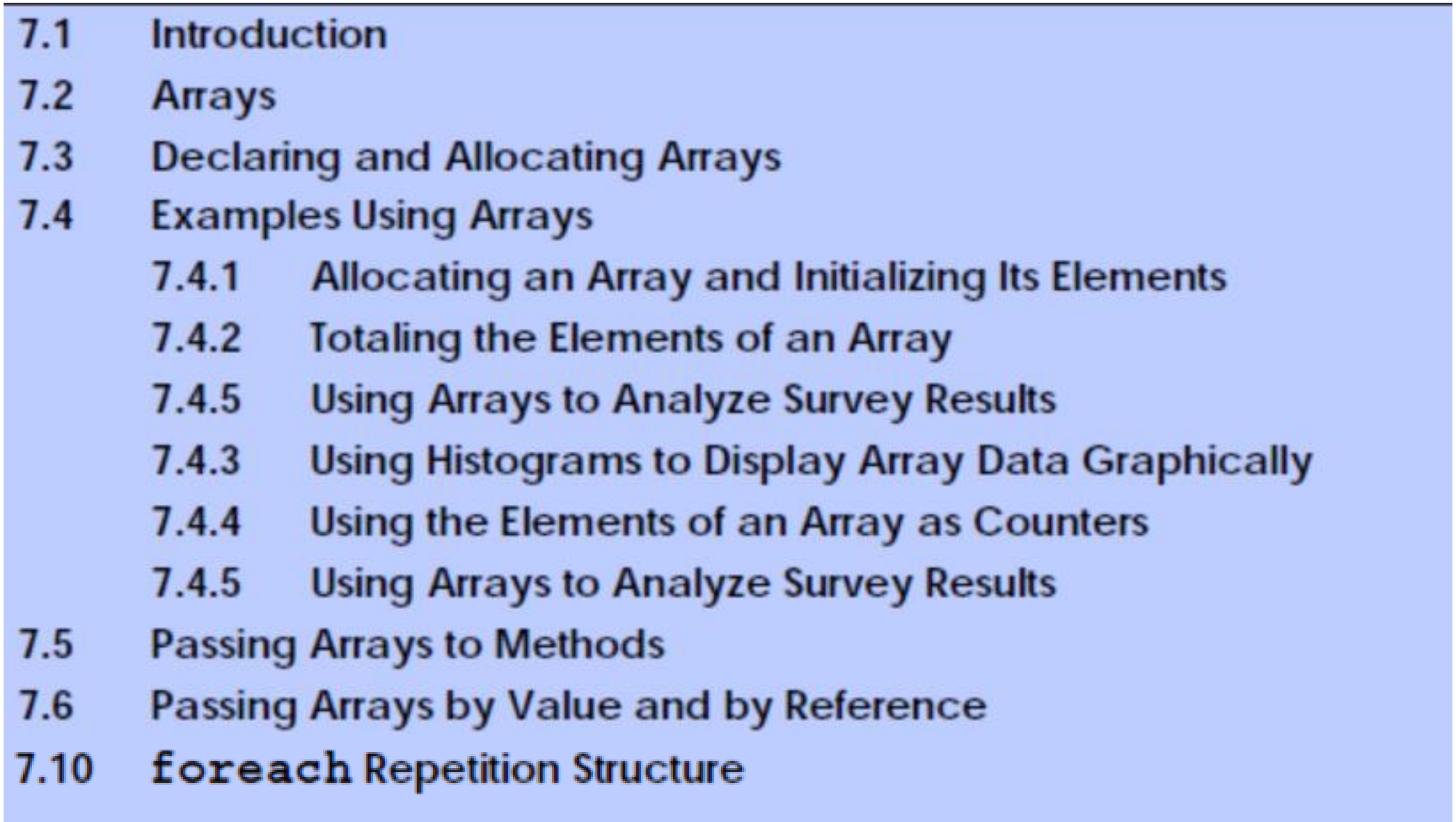
Chapter 7 - Arrays



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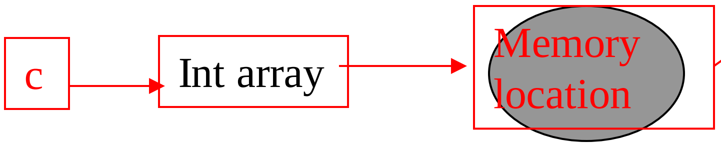
Arrays

- int c[12];
  - c is the array *name*
  - c has 12 *elements* (c[0], c[1], … c[11])
  - c.length is a variable storing array c's *length* (here, its value is 12)



c[0]	-45
c[1]	6
c[2]	0
c[3]	72
c[4]	1543
c[5]	-89
c[6]	0
c[7]	62
c[8]	-3
c[9]	1
c[10]	6453
c[11]	78

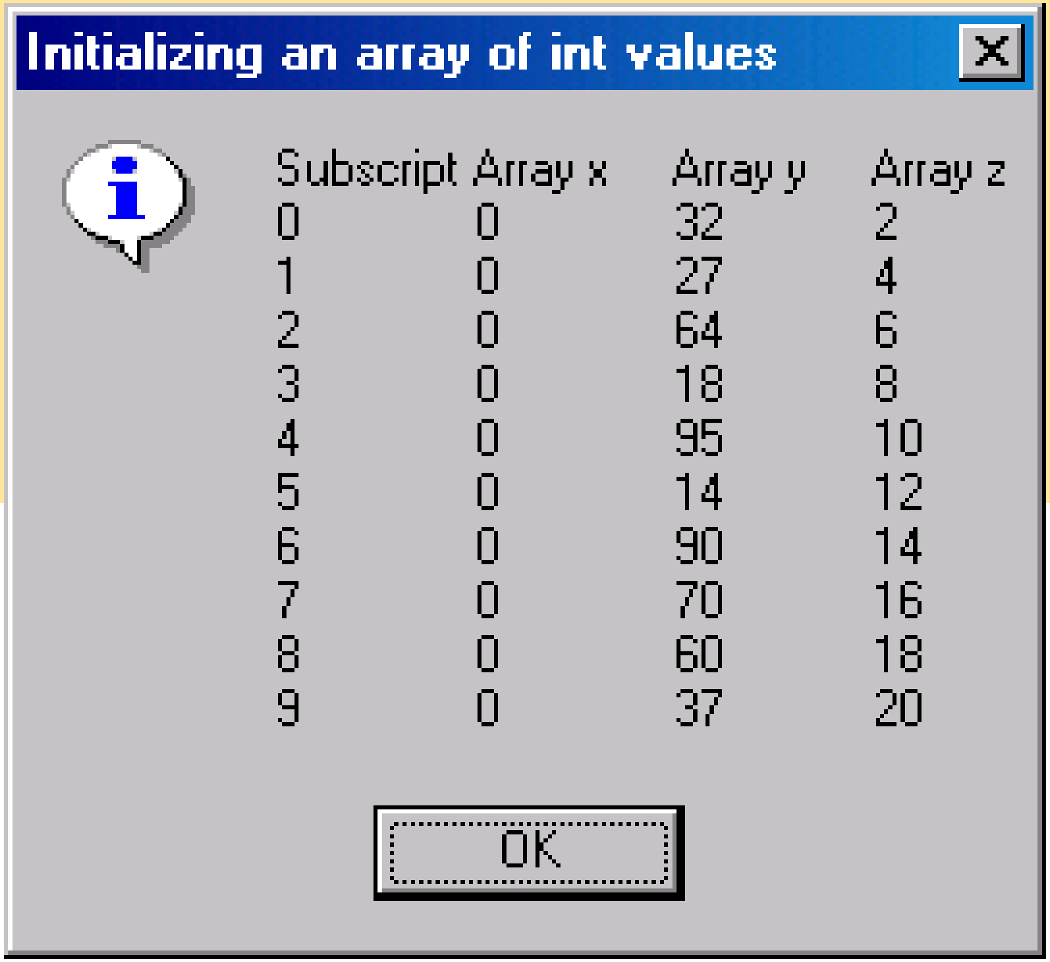
7.3 Declaring and Allocating Arrays

- Array declarations and initializations need not be in the same statement
- **new** operator to allocate dynamically the number of elements in the array
  - “**new**” is to specify how many elements OS will give to the array
- Arrays can be initialized in declaration
  - with *initializer list*
    - The list contains the number of elements and their values

```
using System;
using System.Windows.Forms;
class InitArray
{
  static void Main( string[] args )
   {
     string output = "";
     int[] x;
     x = new int[ 10 ];
     int[] y={32,27,64,18, 95, 14, 90, 70, 60, 37};
     const int ARRAY_SIZE = 10;
     int[] z;
     z = new int[ ARRAY_SIZE ];
     for ( int i = 0; i < z.Length; i++ )
        z[ i ] = 2 + 2 * i;
     output += "Subscript\tArray x\tArray y\tArray z\n";

```

```
      for ( int i = 0; i < ARRAY_SIZE; i++ )
         output += i + "\t" + x[ i ] + "\t" + y[ i ] +
            "\t" + z[ i ] + "\n";
      MessageBox.Show( output,
      "Initializing an array of int values",
      MessageBoxButtons.OK,
      MessageBoxIcon.Information );
   }
}
```



Initializing an array of int values

```
Subscript Array x     Array y     Array z
0         0           32          2
1         0           27          4
2         0           64          6
3         0           18          8
4         0           95          10
5         0           14          12
6         0           90          14
7         0           70          16
8         0           60          18
9         0           37          20
```

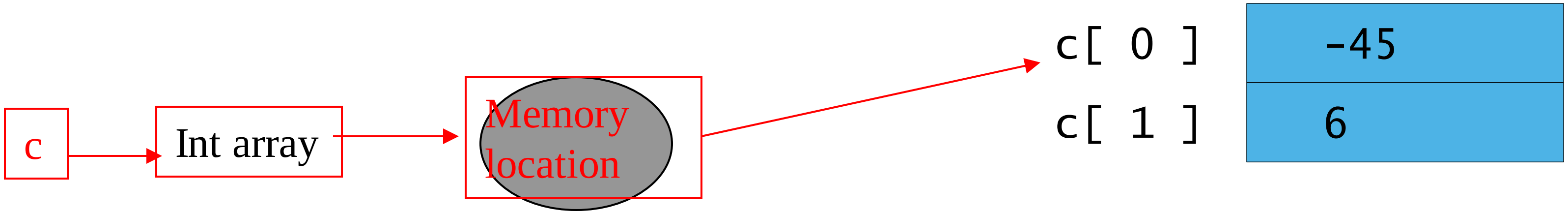
Declaring and Allocating Arrays

- Declaring and Allocating arrays
  - Arrays are objects (i.e., reference variable) that occupy memory
  - Allocated dynamically with operator **new**

```
int[] c = new int[ 2 ];
```

  - The result is equivalent to

```
int[] c;                // declare array
 c = new int[ 2 ]; // allocate array
```



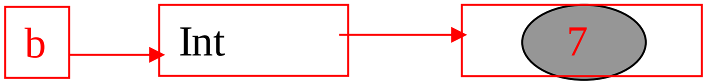
String and general Arrays

- In C, Java, when declare a string variable and assign content to it
  - **One more char** (string stop sign '\0') is appended to the end of the string
    - As the indicator to denote the end of the string
  - In Delphi, no such a char is appended
    - They use the first element of the array to store the length of the array.
      - i.e., array[0] stores the length of the array
- If you want to give the content to a string variable, one char by one char, in the program,
  - you should add '\0' by yourself
  - Otherwise, the string operation will error

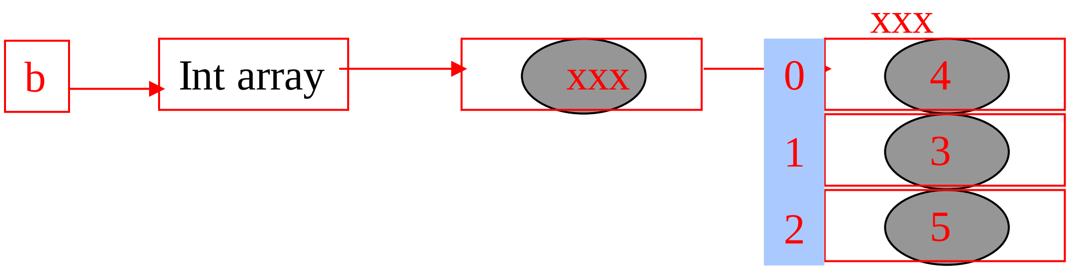
```
string st;
st[1] = 'o';
st[2] = 'k';
st[3] = '\0';
```

Compare String array and general Arrays

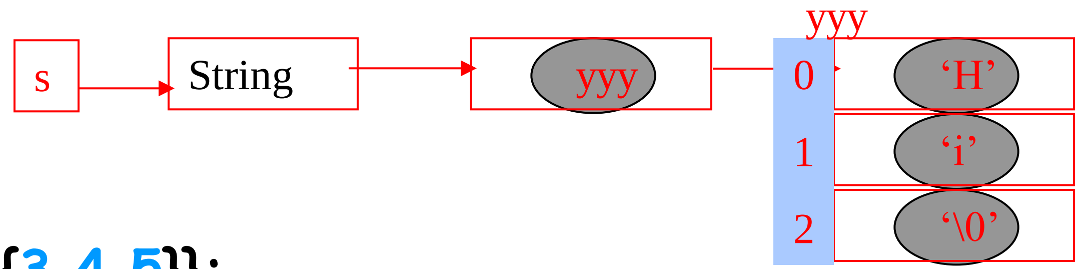
- int b = 7;



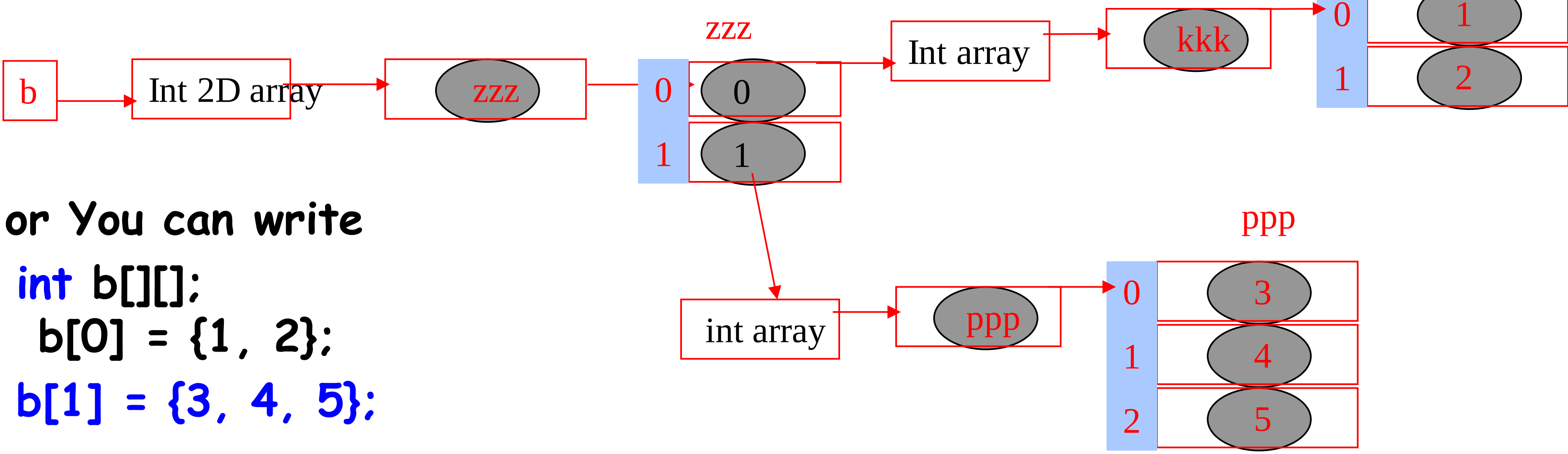
- int[] b = {4, 3, 5};



- string s = “Hi”;



- int[][] b ={{1,2},{3,4,5}};

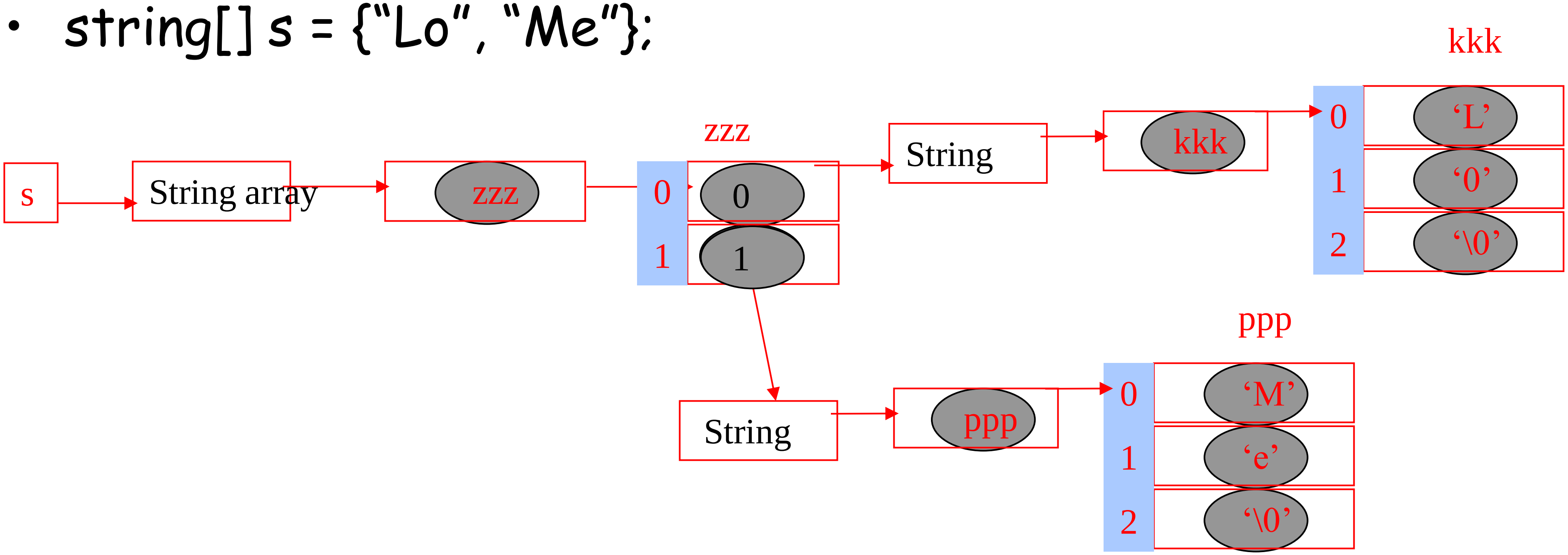


-or You can write

```
int b[][];
 b[0] = {1, 2};
b[1] = {3, 4, 5};
```

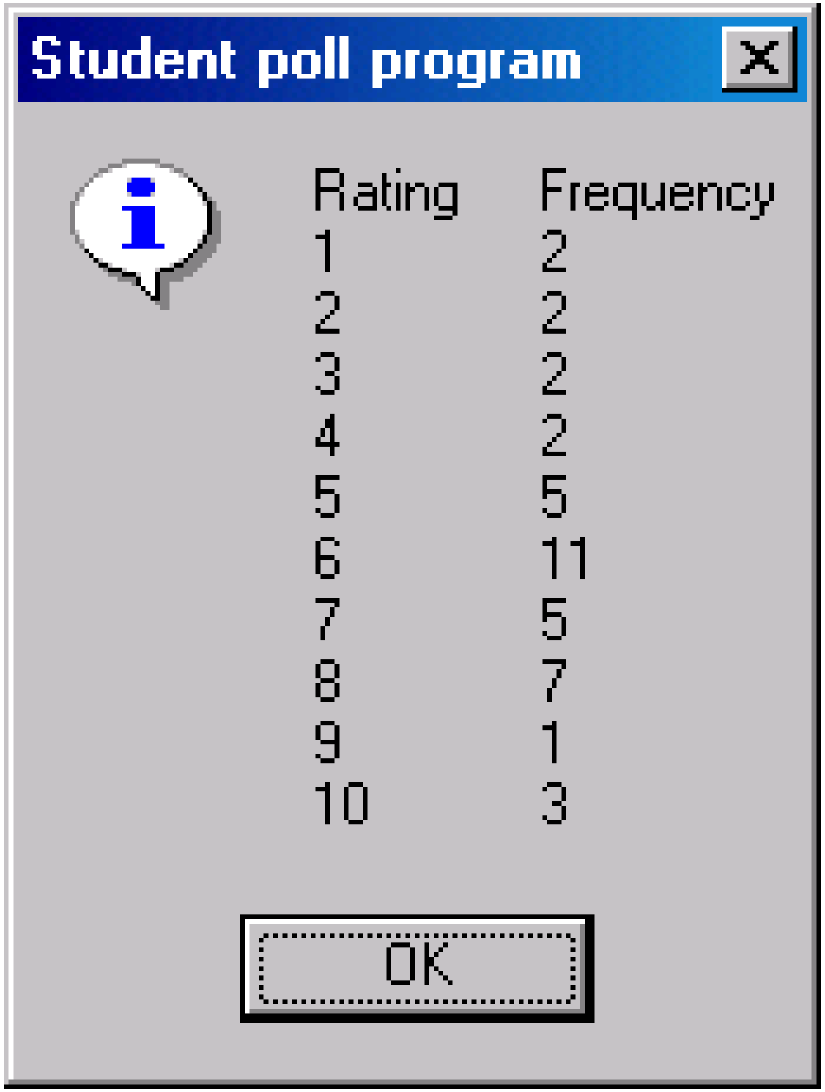
Compare String array and general Arrays

- string[] s = {"Lo", "Me"};



```
using System;
using System.Windows.Forms;
class StudentPoll
{
    static void Main( string[] args )
    {
     int[] responses= {1, 2, 6, 4, 8, 5, 9, 7, 8, 10, 1,
      6, 3, 8, 6, 10, 3, 8, 2, 7, 6, 5, 7, 6, 8, 6, 7,
      5, 6, 6, 5, 6, 7, 5, 6, 4, 8, 6, 8, 10 };
     int[] frequency = new int[ 11 ];
     string output = "";
     for (int answer=0; answer<responses.Length;
      answer++ )
         ++frequency[ responses[ answer ] ];
     output += "Rating\tFrequency\n";
     for ( int rating = 1; rating < frequency.Length;
      rating++)
         Output +=rating+"\t"+frequency[rating] + "\n";
      MessageBox.Show( output, "Student poll program",
         MessageBoxButtons.OK,
        MessageBoxIcon.Information );
    } }
```

StudentPoll.cs
Program Output



```
Rating   Frequency
1        2
2        2
3        2
4        2
5        5
6        11
7        5
8        7
9        1
10       3
```

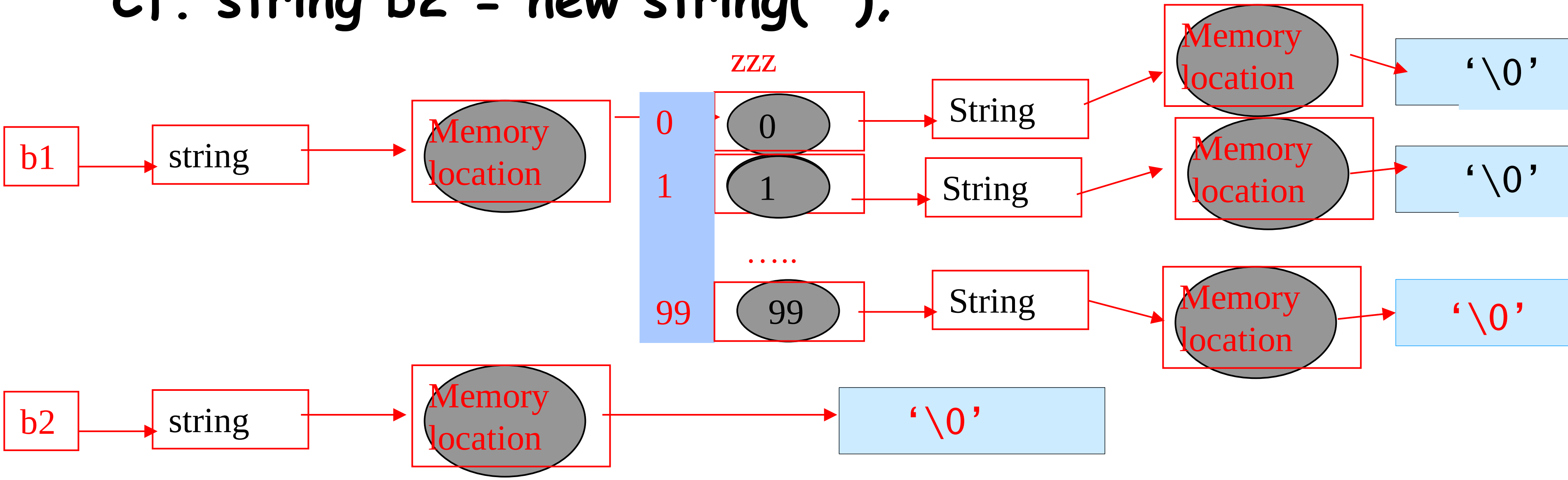
Declaring and Allocating Arrays

- We can allocate arrays of objects, too

  String [] b1 = new String[100];

  // to allocate 100 strings for b

  Cf. string b2 = new string("");



- String a=new String("aaaaa"); 和 String a; a="aaaaa"; 有區別嗎？

Passing Arrays to Methods

- In Java, C#, every object is pass-by-reference
  - The called and caller share the same data space (i.e., the fourth box shared by both)
- In Java, C#, arrays are objects
  - Therefore, arrays are passed to methods by reference
  - But if passing an element of array, the element is passed by value
- To pass array argument to a method
  - Specify array name without brackets [ ], like
    - Array **hourlyTemperatures** is declared as

      ```
      int[] hourlyTemperatures = new int[24];
      ```

    - The method calling is written as

      ```
      modifyArray(hourlyTemperatures);
      ```

7.9 Multiple-Subscripted Arrays

- Rectangular arrays
  - Often represent tables in which each row is the same size and each column is the same size
  - By convention, first subscript identifies the element's row and the second subscript the element's column
- Jagged Arrays
  - Arrays of arrays
  - Arrays that compose jagged arrays can be of different lengths

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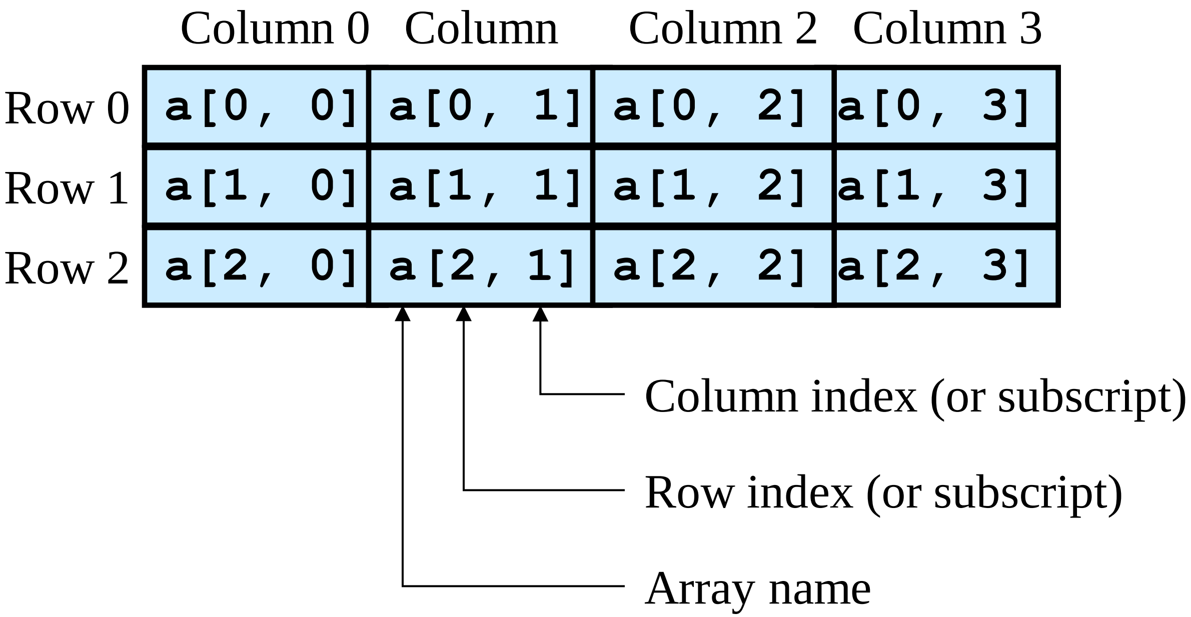
7.9 Multiple-Subscripted Arrays



	Column 0	Column	Column 2	Column 3
Row 0	`a[0, 0]`	`a[0, 1]`	`a[0, 2]`	`a[0, 3]`
Row 1	`a[1, 0]`	`a[1, 1]`	`a[1, 2]`	`a[1, 3]`
Row 2	`a[2, 0]`	`a[2, 1]`	`a[2, 2]`	`a[2, 3]`

Column index (or subscript)

Row index (or subscript)

Array name

Fig. 7.13 Double-subscripted array with three rows and four columns.

7.10 foreach Repetition Structure

- foreach
  - repetition structure
  - is used to iterate through values in data structures such as arrays
  - A variable is used as a counter to represent the value of each element

```
using System;
class ForEach
{
   static void Main( string[] args )
   {
      int[,] gradeArray = { { 77, 68, 86, 73 },
         { 98, 87, 89, 81 }, { 70, 90, 86, 81 } };
      int lowGrade = 100;
      foreach ( int grade in gradeArray )
      {
         if ( grade < lowGrade )
            lowGrade = grade;
      }
      Console.WriteLine( "The minimum grade is: " + lowGrade );
   }
}
```

```
The minimum grade is: 68
```