Programming – TU857/1

Lab 7 – Monday, November 13th, 2023

Note: You are expected to finish all programmes in your own time if you do not get these done during the lab session. This is your own responsibility.

Arrays (part 2)

Remember: Use Symbolic names in your programs. Do not hard code.

Write separate programs to:

1. Assuming an integer array called 'arr' with 10 elements, what is in arr[8] after the following code is executed?

```
for (i = 0; i < 10; i++)
{
        arr[i] = 9 - i;
}
// Display the contents of arr[8]

for (i = 0; i < 10; i++)
{
        arr[i] = arr[ arr[i] ];
}
// Display the contents of arr[8]
```

   Include this code in a full program, compile and run it. Display the contents of arr[8] to see its contents. Do you understand how it works and what is happening? I suggest you step through the process on paper to understand it.

2. **Mandatory Exercise Question – You must complete and Demo to your Lab TA**

   Write a program that uses a 3x2 (2-D) array. Your program must do the following:

   a) Enter values into the array
   b) Display the values in the array
   c) Find the smallest & largest value and display both to standard output
   d) Calculate the average of the values and display to standard output

3. Write a program for the following questions (see screen shot below):

   - Q4 (use a 1-D array)

- Q5
- Q9

Exercises

1. What are the subscript ranges of the following arrays?

   (a) `int array1[6] ;`
   (b) `float array2[] = { 1.3, 2.9, 11.8, 0 } ;`
   (c) `int array3[6][3] ;`
   (d) `int array4[][4] = { { 6, 2, 1, 3 } , { 7, 3, 8, 1 } } ;`

2. Write statements to define each of the following:
   (a) a one-dimensional array of floating-point numbers with ten elements
   (b) a one-dimensional array of characters with five elements
   (c) a two-dimensional array of integers with seven rows and eight columns
   (d) a 10 by 5 two-dimensional array of double precision numbers
   (e) a 10 by 8 by 15 three-dimensional array of integers.

3. What is the output from the following program segment?

```
int i, c1 = 0, c2 = 0 ;
int a[] = { 6, 7,3, 13, 11, 5, 1, 15, 9, 4 } ;
for ( i = 0; i < 10; i++ )
{
  if( i%2 == 0 )
    c1++ ;
  if ( a[i]%2 == 0 )
    c2++ ;
}
printf( "c1=%d c2=%d\n", c1, c2 ) ;
```

4. Write a program to read in fifteen numbers and display them as follows:

   (a) each number on a separate line
   (b) on one line, each number separated by a single space
   (c) as in (b) but in the reverse order to which they were input.

5. Write a program to input numbers to two one-dimensional arrays, each having five elements, and display the result of multiplying corresponding elements together.

6. The number of users logging into a network every hour is input from the keyboard into a 24-element integer array. Write a program to display a report of the form:

```
    Time            Number of logins   Percentage of total
 0:00 - 1:00                1                  0.3
 1:00 - 2:00                2                  0.7
...etc
 9:00 - 10:00              25                  8.3
10:00 - 11:00              27                  9.0
11:00 - 12:00              28                  9.3
...etc
23:00 - 0:00                8                  2.7

Maximum logins 28 occurred between 11:00 and 12:00
Minimum logins  1 occurred between  0:00 and  1:00
```

7. The following two arrays represent the fixed and variable costs involved in producing each of eight items:

```
float fixed[]    =  { 11.31, 12.12, 13.67, 11.91, 12.30,
                      11.8, 11.00, 12.00 } ;

float variable[] = { 1.12, 1.13, 3.14, 1.35, 2.20, 1.28,
                      1.00, 2.10 } ;
```

   Write a program to input an item number in the range 1 to 8 along with the number of units produced. The program should then display the cost of producing that number of units.

8. Use two `for` loops to set all the diagonal elements of a 9 by 9 integer array to 1 and all the elements not on a diagonal to 0.

9. Write a program to input values to a 4 by 5 array, search the array for values that are less than 0 and display these values along with their row and column indices.

10. Write a program to input ten integer values into an array `unsorted`. Your program should then loop through `unsorted` ten times, selecting the lowest value during each pass. For each pass through the loop, the element in `unsorted` containing the lowest value is replaced with a large value (e.g. 9999) after copying it into the next available element of another integer array `sorted`.

    This is illustrated below:

    `unsorted` at the start: 14 22 67 31 89 11 42 35 65 49
    `sorted` at the start:

    `unsorted` after the first pass: 14 22 67 31 89 9999 42 35 65 49
    `sorted` after the first pass: 11

    `unsorted` after the second pass: 9999 22 67 31 89 9999 42 35 65 49
    `sorted` after the second pass: 11 14

    etc.

    Display the values in `sorted`. (Hint: see program P7C to determine the smallest value.)

11. In a magic square the rows, columns and diagonals all have the same sum. For example:

17	24	1	8	15
23	5	7	14	16
4	6	13	20	22
10	12	19	21	3
11	18	25	2	9

and

4	9	2
3	5	7
8	1	6

    Write a program to read in a two-dimensional integer array and check if it is a magic square.