

COS 135 Individual Assignment Week 7

Due: Friday 03/15/19 End of the day (late submissions -10%)

This assignment has 2 sections (part #1 and part #2) in **9 pages**. Please submit a .zip file with answers (**answering template is attached for part #1**) and complete source codes for part #2.

Part #1 (30pts) Select or write the most appropriate answer (please use the answering template provided).

1. what is the output of following program?

```
#include<stdio.h>

int main()
{
    int a[5] = {5, 1, 15, 20, 25};
    int i, j, m;
    i = ++a[1];
    j = a[1]++;
    m = a[i++];
    printf("%d, %d, %d", i, j, m);
    return 0;
}
```

- a) 2, 1, 15
- b) 1, 2, 5
- c) 3, 2, 15
- d) 2, 3, 20

2. What are the disadvantages of arrays as data structures?

- a) We must know before-hand how many elements will be there in the array
- b) There are chances of wastage of memory space if elements inserted in an array are lesser than the allocated size
- c) Insertion and deletion becomes tedious
- d) All of the mentioned

3. What will be output of following c code?

```
#include<stdio.h>

int main()
{
    int arr[5], i=-1, z;
    while(i<5)
        arr[i]=++i;

    for(i=0; i<5; i++)
        printf("%d ", arr[i]);

    printf("\n");
    return 0;
}
```

- a) 1 2 3 4 5
- b) -1 0 1 2 3 4
- c) 0 1 2 3 4
- d) 0 -1 -2 -3 -4

4. Which of the following statements mentioning the name of the array DOES NOT yield the base address?

- A. When array name is used with the **sizeof** operator.
- B. When array name is operand of the **&** operator.
- C. When array name is passed to **scanf()** function.
- D. When array name is passed to **printf()** function.

- a) A
- b) A, B
- c) B
- d) B, D

5. What will be the output of the program if the array begins at 65486 and each integer occupies 2 bytes?

```
#include<stdio.h>

int main()
{
    int arr[] = {12, 14, 15, 23, 45};
    printf("%u, %u\n", arr+1, &arr+1);
    return 0;
}
```

- a) 65488, 65490
- b) 64490, 65492
- c) 65488, 65496
- d) 64490, 65498

6. What does the following declaration mean?

```
int (*ptr)[10]
```

- a) ptr is array of pointers to 10 integers
- b) ptr is a pointer to an array of 10 integers
- c) ptr is an array of 10 integers
- d) ptr is an pointer to array

7. Which of the following statements are correct about an array?

- A. The array `int num[26]`; can store 26 elements.
- B. The expression `num[1]` designates the very first element in the array.
- C. It is necessary to initialize the array at the time of declaration.
- D. The declaration `num[SIZE]` is allowed if `SIZE` is a macro.

- a) A
- b) A, D
- c) B, C
- d) B, D

8. What will be output of following c program?

```
#include<stdio.h>

void fun(int **p)
{
    printf("%d\n", **p);
}

int main()
{
    int a[3][4] = {1, 2, 3, 4, 4, 3, 2, 8, 7, 8, 9, 0};
    int *ptr;
    ptr = &a[0][0];
    fun(&ptr);
    return 0;
}
```

- a) 1
- b) 2
- c) 3
- d) 4

9. What will be the output of the program if the array begins 1200 in memory?

```
#include<stdio.h>

int main()
{
    int arr[]={2, 3, 4, 1, 6};
    printf("%u, %u, %u", arr, &arr[0], &arr);
    return 0;
}
```

- a) 1200, 1202, 1204
- b) 1200, 1200, 1200
- c) 1200, 1204, 1208
- d) 1200, 1202, 1200

10. Let x be an array. Which of the following operations are illegal?

- A. ++x
 - B. x + 1
 - C. x++
 - D. x * 2
-
- a) A, B
 - b) A, B, C
 - c) B, C
 - d) A, C, D

Part #2 (70pts): write separate C programs for following tasks and submit your source codes.

Special instructions:

Comments are required in the following locations:

- At the top of the source code comment your name and a short program description.
- Comment the purpose of variables, functions, and other elements in your code.
- Comment major sections of code such as input, processing, and output.

Program Design:

Your program is a professional document and must be neat and easy to read. All programs should follow the listed specifications.

- Comments should be aligned and entered in a consistent fashion
- Blank lines should be added to aid readability
- Code within blocks should be indented
- Comments should not contain spelling mistakes
- Variable names should be meaningful
- Define functions and data structures where necessary
- Optimize your code: least possible number of lines to produce the output
- Error handling: you should handle all the possible error conditions and invalid inputs

(a) (40pts):

To multiply a matrix by another matrix we need to calculate the **dot product** of rows and columns. Write a C program to multiply two matrices (two-dimensional arrays).

1. First, the program should ask the user to enter the size of the matrix (rows and columns) in the format of: **2 x 3** (assume user only enters single digit numbers between 0 - 9).
2. Then, your program should generate **random numbers between 1 and 9 (including the numbers 1 and 9)** to fill the matrix.

Now, continue the above two steps for the second matrix.

Validation:

- To multiply a matrix by another matrix, **the number of columns of the 1st matrix must equal to the number of rows of the 2nd matrix.**
- The result should have the same number of rows as the 1st matrix, and the same number of columns as the 2nd matrix.

Background info: "How to multiply matrices" - <https://www.youtube.com/watch?v=2spTnAiQg4M>

If the orders of the matrices are such that they can't be multiplied by each other, then an error message should be displayed.

Finally, multiply them and save the results in a new matrix, and display the results in the following format:

$$\begin{array}{ccc} 1 & 3 & 4 \\ 8 & 2 & 2 \end{array} \cdot \begin{array}{ccc} 2 & 7 & 9 \\ 3 & 4 & 5 \\ 3 & 9 & 1 \end{array} = \begin{array}{ccc} 23 & 55 & 28 \\ 28 & 82 & 84 \end{array}$$

Sample output #1:

Enter number of rows and columns of first matrix (format: r x c): 2 x 3

Enter number of rows and columns of second matrix (format: r x c): 4 x 6

Program output:

Error: The 2 x 3 matrix can't be multiplied by 4 x 6 matrix.

Reason: the number of columns of the 1st matrix must equal to the number of rows of the 2nd matrix.

Sample output #2:

Enter number of rows and columns of first matrix (format: r x c): 2 x 0

Program output:

Error: The number of rows or columns of a matrix can't be 0.

Please try again.

Enter number of rows and columns of first matrix (format: r x c):

Sample output #3:

Enter number of rows and columns of first matrix (format: r x c): 2 x 2

Enter number of rows and columns of second matrix (format: r x c): 2 x 3

Program output:

```
2 3   4 9 1 = 17 42 20
5 7 . 3 8 6   41 101 47
```

(b) (30pts):

In a separate .c file, modify the program you developed in part #2 (a) to apply the concept into the following real-life scenario.

A local bakery sells 3 types of products: Bagel, Flatbread, and Muffin.

Bagel cost \$3 each

Flatbread cost \$4 each

Muffin cost \$1 each

Based on matrix multiplication, develop a C program to calculate the total sales (as well as sales in individual days) of a weekend.

You may save above cost info in a 1 x 3 matrix (array) as below:

[3 4 1]

The user has to enter the sales information one by one (as mentioned in the sample outputs):

Imagine following sales in a weekend.

	Saturday	Sunday
Bagel	12	9
Flatbread	21	8
Muffin	32	43

The program should use the matrix multiplication and generate the result in a new matrix as below.

$$\begin{array}{r} 3 \ 4 \ 1 \ . \ 12 \ 9 \ = \ 152 \ 102 \\ \quad \quad 21 \ 8 \\ \quad \quad 32 \ 43 \end{array}$$

Output above results as:

Total sales on Saturday: \$ 152

Total sales on Sunday: \$ 102

Total sales on weekend: \$ 254

Sample output #1:

Number of Bagel sales on Saturday: 12
Number of Flatbread sales on Saturday: 21
Number of Muffin sales on Saturday: 32
Number of Bagel sales on Sunday: 9
Number of Flatbread sales on Sunday: 8
Number of Muffin sales on Sunday: 43

Program output:

```
3 4 1 . 12 9 = 152 102
      21 8
      32 43
```

Total sales on Saturday: \$ 152
Total sales on Sunday: \$ 102
Total sales on weekend: \$ 254

Sample output #2:

Number of Bagel sales on Saturday: 12
Number of Flatbread sales on Saturday: A

Program output:

Error: Sales figures must be numbers.
Please try again.

Number of Flatbread sales on Saturday: