ENG EK 125 - Worksheet C Chapter 3

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1) Write a program to initialize a one-dimensional array of 8 random numbers, and then
- Print all of the values from the array.
- Print the array values in reverse.

```c
1    #include <stdlib.h>
2    #include <time.h>
3    #include <stdio.h>
4
5    int main(){
6        int N = 8,
7            a[N];
8
9        srand(time(NULL));
10
11        for (int i = 0; i <= N; ++i){
12            a[i] = rand()%9 + 1;
13            printf("%d", a[i]);
14        }
15        printf("\n");
16
17        for (int i = N; i >= 0; --i){
18            printf("%d", a[i]);
19        }
20        printf("\n");
21        return 0;
22    }
```

```
chena8@WIT4500
tro to Program
$ ./WSC3_1
332358165
561853233
```

2) Write your own program to declare at least two string variables, initialize them, and print them.
- Try different ways of initializing the string variables, including reading into them.
- Try all of the string functions mentioned; make sure that you understand them!

```c
1    #include <stdio.h>
2    #define N 3
3
4    int main(){
5        char mystr[3] = "hi",
6             mystr2[N] = {'h', 'i', '\0'},
7             newstr;
8
9        printf("Enter a string: ");
10       gets(mystr);
11
12       for (int i = 0; i < N; ++i)
13       {
14           printf("%c", mystr[i]);
15       }
16       printf("\n");
17
18       for (int i = 0; i < N; ++i)
19       {
20           printf("%c", mystr2[i]);
21       }
22       return 0;
23   }
```

```
chena8@WIT45005546 /cygdri
tro to Programming/C/WSC3
$ ./WSC3_2
Enter a string: hi world
hi
hi
```

3) Write a program to initialize a two-dimensional array (matrix) of random numbers, and then implement some common operations on the matrix. Put all of this in one program, but do the program one part at a time (in other words, write the basic program that initializes the array, then add the part that prints it, then add the part that calculates the overall average, etc.)

    a) Initialize a 2-dimensional array of random integers. The array should have 8 rows and 4 columns (to make the program easier to change later, use constants for these values). Initialize every element to be a random integer in the range from 0 to 100.

```c
1    #include <stdio.h>
2    #include <stdlib.h>
3    #include <time.h>
4    #include <math.h>
5    #define ROWS 8
6    #define COLS 4
7
8    int main(){
9        float arr[ROWS][COLS],
10
11       srand(time(NULL));
12
13       for (int i = 0; i < ROWS; ++i)
14       {
15           for (int j = 0; j < COLS; ++j)
16           {
17               arr[i][j] = rand()%101;
18           }
19       }
20       return 0;
21   }
```

b) Print the values from the array, in a table format.

```c
1    #include <stdio.h>
2    #include <stdlib.h>
3    #include <time.h>
4    #include <math.h>
5    #define ROWS 8
6    #define COLS 4
7
8    int main(){
9        float arr[ROWS][COLS];
10
11       srand(time(NULL));
12
13       for (int i = 0; i < ROWS; ++i)
14       {
15           for (int j = 0; j < COLS; ++j)
16           {
17               arr[i][j] = rand()%101;
18               printf("%.1f    ", arr[i][j]);
19           }
20           printf("\n");
21       }
22       return 0;
23   }
```

```
chena8@WIT45005546 /cygdrive/c
tro to Programming/C/WSC3
$ ./WSC3_3B
56.0    13.0    27.0    93.0
17.0    29.0    75.0    11.0
62.0    70.0    42.0    22.0
15.0    21.0    19.0    88.0
64.0    24.0    51.0    94.0
59.0    53.0    12.0    82.0
26.0    60.0    9.0     94.0
43.0    59.0    45.0    91.0
```

c) Calculate the overall average of all values in the array.

```c
1    #include <stdio.h>
2    #include <stdlib.h>
3    #include <time.h>
4    #include <math.h>
5    #define ROWS 8
6    #define COLS 4
7
8    int main(){
9        float arr[ROWS][COLS],
10           totsum = 0,
11           avg;
12
13       srand(time(NULL));
14
15       for (int i = 0; i < ROWS; ++i)
16       {
17           for (int j = 0; j < COLS; ++j)
18           {
19               arr[i][j] = rand()%101;
20               printf("%.1f    ", arr[i][j]);
21               totsum = totsum + arr[i][j];
22           }
23           printf("\n");
24       }
25       avg = totsum / (ROWS * COLS);
26       printf("The overall average of the array is %.2f.\n", avg);
27
28       return 0;
29    }
```

```
chena8@WIT45005546 /cygdrive/c/Users/chena8
tro to Programming/C/WSC3
$ ./WSC3_3C
71.0    21.0    94.0    97.0
15.0    97.0    49.0    51.0
38.0    87.0    40.0    12.0
74.0    12.0    47.0    53.0
21.0    50.0    65.0    21.0
11.0    7.0    81.0    6.0
58.0    74.0    54.0    67.0
5.0    17.0    43.0    67.0
The overall average of the array is 47.03.
```

d) Calculate and print the average of each row.

```c
#include <stdio.h>
#include <stdlib.h>
#include <time.h>
#include <math.h>
#define ROWS 8
#define COLS 4

int main(){
    float arr[ROWS][COLS],
        rowtot = 0,
        avg[ROWS];

    srand(time(NULL));

    for (int i = 0; i < ROWS; ++i)
    {
        for (int j = 0; j < COLS; ++j)
        {
            arr[i][j] = rand()%101;
            printf("%.1f    ", arr[i][j]);
            rowtot = rowtot + arr[i][j];
        }
        avg[i] = rowtot / COLS;
        rowtot = 0;
        printf("\n");
    }

    for (int k = 0; k < ROWS; ++k)
    {
        printf("The average of row %d is %.2f.\n", k+1, avg[k]);
    }

    return 0;
}
```

```
chena8@WIT45005546 /cygdrive/c/
tro to Programming/C/WSC3
$ ./WSC3_3D
18.0    44.0    53.0    51.0
21.0    27.0    49.0    75.0
11.0    36.0    77.0    0.0
68.0    1.0    43.0    56.0
75.0    5.0    36.0    27.0
80.0    98.0    82.0    66.0
38.0    60.0    50.0    43.0
12.0    83.0    94.0    40.0
The average of row 1 is 41.50.
The average of row 2 is 43.00.
The average of row 3 is 31.00.
The average of row 4 is 42.00.
The average of row 5 is 35.75.
The average of row 6 is 81.50.
The average of row 7 is 47.75.
The average of row 8 is 57.25.
```

e) Calculate and print the average of each column.

```c
#include <stdio.h>
#include <stdlib.h>
#include <time.h>
#include <math.h>
#define ROWS 8
#define COLS 4

int main(){
    float arr[ROWS][COLS],
          coltot[COLS] = {0, 0, 0, 0},
          avg[COLS];

    srand(time(NULL));

    for (int i = 0; i < ROWS; ++i)
    {
        for (int j = 0; j < COLS; ++j)
        {
            arr[i][j] = rand()%101;
            printf("%.1f    ", arr[i][j]);
            coltot[j] = coltot[j] + arr[i][j];
        }
        printf("\n");
    }

    for (int k = 0; k < COLS; ++k)
    {
        avg[k] = coltot[k] / ROWS;
        printf("The average of column %d is %.2f.\n", k+1, avg[k]);
    }
    return 0;
}
```

```
chena8@WIT45005546 /cygdrive/c/Use
tro to Programming/C/WSC3
$ ./WSC3_3E
42.0    0.0     79.0     9.0
85.0    35.0    47.0     36.0
17.0    94.0    72.0     44.0
76.0    46.0    75.0     92.0
87.0    74.0    42.0     21.0
22.0    15.0    87.0     8.0
70.0    8.0     42.0     71.0
5.0     43.0    75.0     58.0
The average of column 1 is 50.50.
The average of column 2 is 39.38.
The average of column 3 is 64.88.
The average of column 4 is 42.38.
```

4) A complex number is a number of the form a + ib, where a is called the real part, b is called the imaginary part, and i = $\sqrt{-1}$. In this problem, you do NOT calculate a complex number; rather you will just read in the real and imaginary parts and print them.

- Write a program that defines a type for a structure for a complex number (it should have two members, for the real and imaginary parts).
- Prompt the user separately to enter values for the real and imaginary parts, and store them in a structure variable of this type.
- Print the complex number in the form a + ib. (Just print the value of a, then the string "+ i", and then the value of b).

```c
1    #include <stdio.h>
2
3 ▼ int main(){
4        typedef struct
5 ▼        {
6            int real,
7                imag;
8        } complexnum;
9
10       complexnum real,
11                  imag;
12
13       printf("Enter the real component: ");
14       scanf("%d", &real);
15       printf("Enter the imaginary component: ");
16       scanf("%d", &imag);
17
18       printf("%d + i%d\n", real, imag);
19       return 0;
20   }
```

```
chena8@WIT45005546 /cygdrive/c/Us
tro to Programming/C/WSC3
$ ./WSC3_4
Enter the real component: 3
Enter the imaginary component: 5
3 + i5
```

5) Modify your program to have an array of structures for complex numbers.

```c
#include <stdio.h>
#define N 3

int main(){
    typedef struct
    {
        int real,
            imag;
    } complexnum;

    complexnum real[N],
               imag[N];

    for (int i = 0; i < N; ++i)
    {
        printf("Enter the real component: ");
        scanf("%d", &real[i]);
        printf("Enter the imaginary component: ");
        scanf("%d", &imag[i]);

        printf("%d + i%d\n", real[i], imag[i]);
    }
    return 0;
}
```

```
chena8@WIT45005546 /cygdrive/c/User
tro to Programming/C/WSC3
$ ./WSC3_5
Enter the real component: 3
Enter the imaginary component: 5
3 + i5
Enter the real component: 2
Enter the imaginary component: 7
2 + i7
Enter the real component: 1
Enter the imaginary component: 9
1 + i9
```