Part III: Program Control

1.- Write a program that sums a sequence of integers. Assume that the first integer read with `scanf` specifies the number of values remaining to be entered. Your program should read only one value each time `scanf` is executed. A typical input sequence might be `5 100 200 300 400 500` where the `5` indicates that the subsequent five values are to be summed

2.- Write a program that calculates and prints the average of several integers. Assume the last value read with `scanf` is the sentinel `9999`. A typical input sequence might be `10 8 11 7 9 9999` indicating that the average of all the values preceding `9999` is to be calculated.

3.- Write a program that finds the smallest of several integers. Assume that the first value read specifies the number of values remaining.

4.- Write a program that prints the following patterns separately, one below the other. Use `for` loops to generate the patterns. All asterisks (`*`) should be printed by a single `printf` statement of the form `printf( "*" );` (this causes the asterisks to print side by side). [Hint: The last two patterns require that each line begins with an appropriate number of blanks.]

```
(A)          (B)          (C)              (D)
*            **********   **********            *
**           *********     *********           **
***          ********       ********          ***
****         *******         *******         ****
*****        ******           ******        *****
******       *****             *****       ******
*******      ****               ****      *******
********     ***                 ***     ********
*********    **                   **    *********
**********   *                     *   **********
```

5.- One interesting application of computers is drawing graphs and bar charts (sometimes called “histograms”). Write a program that reads five numbers (each between 1 and 30). For each number read, your program should print a line containing that number of adjacent asterisks. For example, if your program reads the number seven, it should print `*******`.

6.- Write a program that prints a table of the binary, octal and hexadecimal equivalents of the decimal numbers in the range 1 through 256. If you’re not familiar with these number systems, read Appendix C before you attempt this exercise.

7.- Write a program that prints the following diamond shape. You may use `printf` statements that print either a single asterisk (`*`) or a single blank. Maximize your use of repetition (with nested `for` statements) and minimize the number of `printf` statements.

```
    *
   ***
  *****
 *******
*********
 *******
  *****
   ***
    *
```

8.- Modify the program you wrote in previous Exercise (7) to read an odd number in the range 1 to 19 to specify the number of rows in the diamond. Your program should then display a diamond of the appropriate size.

9.- Assume `i = 1`, `j = 2`, `k = 3` and `m = 2`. What does each of the following statements print?

a) `printf( "%d", i == 1 );`

b) `printf( "%d", j == 3 );`

c) `printf( "%d", i >= 1 && j < 4 );`

d) `printf( "%d", m < = 99 && k < m );`

e) `printf( "%d", j >= i || k == m );`

f) `printf( "%d", k + m < j || 3 - j >= k );`

g) `printf( "%d", !m );`

h) `printf( "%d", !( j - m ) );`

i) `printf( "%d", !( k > m ) );`

j) `printf( "%d", !( j > k ) );`

Mandatory

Time to learn state machines with the following program Password State Machine

10.- World population has grown considerably over the centuries. Continued growth could eventually challenge the limits of breathable air, drinkable water, arable cropland and other limited resources. There is evidence that growth has been slowing in recent years and that world population could peak some time this century, then start to decline. For this exercise, research world population growth issues online. Be sure to investigate various viewpoints. Get estimates for the current world population and its growth rate (the percentage by which it's likely to increase this year). Write a program that calculates world population growth each year for the next 75 years, using the simplifying assumption that the current growth rate will stay constant. Print the results in a table. The first column should display the year from year 1 to year 75. The second column should display the anticipated world population at the end of that year. The third column should display the numerical increase in the world population that would occur that year. Using your results, determine the year in which the population would be double what it is today, if this year's growth rate were to persist.