



TP3 Loop Statements

Ex 3.1 Display

What does the following program display? (Show Execution History)

```
int main ( ) {  
    int A=3, B=7, C=5;  
    int Mystery ;  
    while (A) {  
        A --;  
        C++;  
    }  
    printf ("A=%d, B=%d, C=%d \n", A, B, C);  
    Mystery = (A > ((B > C)? B : C)) ? A : ((B > C)? B : C);  
    printf (" Mystery =%d \n", Mystery );  
    return 0; }
```

Ex 3.2 Sum

Write a program that asks the user to enter a positive integer n , then calculates and displays the sum of the factorials of all numbers less than n : $S = \sum_{k=1}^n k!$

Example: For $n=1$: $S=1!$
For $n=2$: $S=1!+2!$
For $n=3$: $S=1!+2!+3!$

Ex 3.3 Fibonacci sequence

Write a program that asks the user to enter a positive integer n then calculates and displays the n th term of the Fibonacci sequence.

The Fibonacci sequence is defined as follows:

$$\begin{cases} U_0 = 0, \\ U_1 = 1, \\ U_n = U_{n-1} + U_{n-2} \quad \text{for } n \geq 2 \end{cases}$$

For example, $U_6 = 8$ because $U_6 = U_5 + U_4 = 5 + 3 = 8$.

Ex 3.4 Square root

The square root of a positive real A can be obtained by an iterative method using the following recurring sequence

$$\begin{cases} U_0 = A/2, \\ U_n = \left(U_{n-1} + \frac{A}{U_{n-1}} \right) / 2 \end{cases}$$

which converges to the square root of A . The calculation stops when the following condition is satisfied:

$$\left| \frac{U_{n+1} - U_n}{U_{n+1}} \right| \leq \varepsilon \quad (\varepsilon \text{ is given})$$

Ex 3.5 Fraction Simplification

Write a program in C language that allows the user to enter a fraction in "numerator/denominator" form and displays the simplified fraction. You can use Euclid's algorithm to find the greatest common divisor (GCD) needed to simplify the fraction.

The program will display the initial fraction and the simplified fraction. For example:

The initial fraction is: 18/24
The simplified fraction is: 3/4

Make sure you correctly handle cases where the user enters non-integer values, null fractions, or fractions with a zero denominator.

Ex 3.6 Multiplication Table

1. Write a program that displays the multiplication table for an arbitrary number n (given by the user). *Example:*

for $n = 7$:
 $1 * 7 = 7$
 $2 * 7 = 14$
 $\vdots$
 $9 * 7 = 63$
 $10 * 7 = 70$

2. Modify your program so that it displays a multiplication table in the following format:

X*Y	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

Ex 3.7 Numerical Patterns

Write a program that requests an integer N from the user and then displays the following numerical patterns: (Exp. $N=4$)

(A)	(B)	(C)
1 2 3 4	1	1
1 2 3	2 3	2 5
1 2	4 5 6	3 6 8
1	7 8 9 10	4 7 9 10