Exercises: Recursion

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1. Write a C program that calculates the sum of the **harmonic series** up to a given integer N:

$$S = 1 + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{N}$$

Example:

1 1.00000	-2 N is must positive number
3 1.83333	0 N is must positive number

2. Write a C program that calculates the sum of the **alternating harmonic series** up to a given integer N:

$$S = 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \cdots + (-1)^{N+1}\frac{1}{N}$$

Example:

1 1.00000	-2 N is must positive number
3 0.83333	0 N is must positive number

3. Write a C program that calculates the multiple of the **product of a series** up to a given integer N:

$$P = \left(1 + \frac{1}{1^2}\right) \times \left(1 + \frac{1}{2^2}\right) \times \left(1 + \frac{1}{3^2}\right) \times \cdots \times \left(1 + \frac{1}{N^2}\right)$$

Example:

1 2.00000	-2 N is must positive number
5 2.49020	0 N is must positive number

4. Write a C program that calculates the sum of the **approximation taylor series** up to a given integer x, N:

$$e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots + \frac{x^N}{N!}$$

Example:

1 1 2.00000	2 -1 N is must positive number
2 5 7.00000	-2 -1 N is must positive number

5. Write a C program that calculates the sum of the **finite geometric series** up to a given integer N and float r:

$$S = 1 + r + r^2 + r^3 + \cdots + r^{N-1}$$

Example:

0.5 1 1.00000	-2 -2 N is must positive number
0.5 4 1.87500	0.5 10 1.99902

6. Write a C program that calculates the sum of **the Factorial series** up to a given integer N:

$$S = 1! + 2! + 3! + \cdots + N!$$

Example:

1 1	-2 N is must positive number
4 33	5 153

7. Write a C program that calculates the sum of **the Squares Series** up to a given integer N:

$$S = 1^2 + 2^2 + 3^2 + \cdots + N^2$$

Example:

1 1	-2 N is must positive number
3 14	5 55

8. Write a C program that calculates the miltiple of **the odd numbers** up to a given integer N:

$$P = 1 \times 3 \times 5 \times \cdots \times (2N - 1)$$

Example:

1 1	-2 N is must positive number
3 15	5 945

9. Write a C program that calculates the sum of **the Finite Arithmetic Sequence** up to a given integer a d N:

$$S = a + (a + d) + (a + 2d) + \cdots + \text{N-th term}$$

Example:

1 1 5 15	5 5 -5 N is must positive number
2 3 4 26	5 5 3 30

10. Write a C program that calculates the sum of the **Finite Exponential Series** up to a given integer a N:

$$S = a + a^2 + a^3 + \cdots + a^N$$

Example:

2 3 14	2 -2 N is must positive number
4 2 20	2 5 62