Homework 3

1. Write programs to accumulate and print the following:

a. where *n* reads from the keyboard.

b. Please show the answer accurate to the 12th decimal place if its decimal part is not zero.

c. This homework is designed **for the loop practice**.
Please **do not use array or pow function**.

(a). $20 + 22 + 24 + \ldots + 2n$ (use only one loop) (no nested loop)

(b). $1 + \frac{1}{3} + \frac{1}{5} + \ldots + \frac{1}{101}$ (use only one loop) (no nested loop)

(c). $1 + \frac{1}{2!} + \frac{1}{3!} + \ldots + \frac{1}{n!}$ (use only one loop) (no nested loop)

(d). $1 - 2 + 3 - 4 + 5 + \ldots + (-1)^{n+1} n$ (use only one loop) (no nested loop)

(e). $1 + (1+2) + (1+2+3) + (1+2+3+4) + \ldots + (1+2+3+\ldots+n)$
(use only one loop) (no nested loop)

Input/Output Example:

Input n = 12
(a) 66
(b) 2.947675838574
(c) 1.718281828286
(d) -6
(e) 364

2. Please write complete programs to calculate, execute and print out the results. Please read integer x from the keyboard.

(a). $S = 1^1 + 2^2 + 3^3 + \ldots + x^x$ (use only one nested loop)

(b). $S = \frac{1}{x^1} - \frac{1}{x^3} + \frac{1}{x^5} - \frac{1}{x^7} + \frac{1}{x^9} - \frac{1}{x^{11}}$ where x >1.

(use only one loop) (no nested loop)

Input/Output Example:

Input x=12
(a) 9211817190184
(b) 0.082758620690

3. Write a program that reads an eight-digit positive integer:

Add the first, third, fifth, seventh digits. (please use loop)

Add the second, fourth, sixth, eight digits.

Multiply the first sum by 2 and add it to the second sum.

Subtract 1 from the total.

Compute the remainder when the total is divided by 10.

Subtract the remainder from 9

Please display the final result.

Only one for loop in this program (nested loop is not allowed).

Input/Output Example:
input NUM = 12345678
ANS: 8

4. A polynomial $a_n x^n + a_{n-1} x^{n-1} + \ldots + a_0$ can be evaluated(計值)

Method I. In a straightforward way by performing the indicated operations.

Method II. An alternative method is to factor the polynomial according to the following formula, known as HORNER'S Rule:

$$(\ldots(((0*x + a_n)x + a_{n-1})x + a_{n-2})x + \ldots + a_1)x + a_0$$

(1). Write two programs to evaluate polynomials by these two different methods. (The order of the polynomial is not greater than 5, and the coefficients are read by the keyboard.)

Please use only one loop for method II (nested loop is not allowed)

(2). Print out the number of multiplications and additions are used in each method.

Ex: f(x)=$5x^4+4x^3+3x^2+2x+1$ (input x from keyboard)

Method(B): let $a_0=1$, $a_1=2$, $a_2=3$, $a_3=4$, $a_4=5$

We have : $f_0=a_4$, $f_1=f_0 * x+a_3$, $f_2=f_1 * x+a_2$, $f_3=f_2 * x+a_1$

$f_4=f_3 * x+a_0=5x^4+4x^3+3x^2+2x+1$ ------->Answer

(In general form $f_i=f_{i-1} * x+a_{n-i}$, $f_0=a_n$)

Input/Output Example:

-----Method I-----
Please input the order: 5
Please input x: 2
Please input a_5: 1
Please input a_4: 2
Please input a_3: 3
Please input a_2: 4
Please input a_1: 5
Please input a_0: 6
Answer: 120, ADD time: 5, MUL time: 15

-----Method II-----
Please input the order: 5
Please input x: 2
Please input a_5: 1
Please input a_4: 2
Please input a_3: 3
Please input a_2: 4
Please input a_1: 5
Please input a_0: 6
Answer: 120, ADD time: 6, MUL time: 6

5. A common highway patro speed-detection radar unit emits a beam of microwaves at a frequency f_0. The beam is reflected off an approaching car, and the reflected beam is picked up and analyzed by the radar unit. The frequency of the reflected beam is shifted slightly from f_0 to f_1 due to the motion of the car. The relationship between the speed of the car, *v*, in miles per hour and the two microwave frequencies is

$$v = (6.685 \times 10^8) \times \frac{f_1 - f_0}{f_1 + f_0}$$

Where the emitted waves have a frequency of $f_0 = 2 \times 10^{10}$ sec^{-1}.

(a).Using this formula, write a program to calculate and display the speed corresponding to a received frequency of 5.0012345×10^{12} sec^{-1}

(b). Modify the above program to determine the frequency that will be returned by a car traveling at 195 miles per hour.

1. Please initialize variables as Scientific Notation (C++ Exponential Notation).
   Ex:The C++ Exponential Notation of 725.83 is 7.258300E+02
2. Use format specifier: double precision %lf and scientific notation %e to print out large numbers and display 13 digits after the decimal point.

Input/Output Example:

```
v = 663174616.3717309200000
v = 6.6317461637173e+008
f1 = 20000011667.9166410000000
f1 = 2.0000011667917e+010
```