Lab 3. Loops And Iteration

Class work

Exercise 1: Write a program which repeatedly reads numbers until the user enters "done". Once "done" is entered, print out the total, count, and average of the numbers. If the user enters anything other than a number, detect their mistake using `try` and `except` and print an error message and skip to the next number.

```
Enter a number: 4

Enter a number: 5

Enter a number: bad data

Invalid input

Enter a number: 7

Enter a number: done

16 3 5.333333333333333
```

Exercise 2: Write another program that prompts for a list of numbers as above and at the end prints out both the maximum and minimum of the numbers instead of the average.

VARIANTS

1. A natural number n is given . Calculate:

$$\left(1+\frac{1}{1^2}\right)\left(1+\frac{1}{2^2}\right)\ldots\left(1+\frac{1}{n^2}\right)$$

2. A natural number n is given . Calculate:

$$\frac{1}{\sin 1}+\frac{1}{\sin 1+\sin 2}+\cdots+\frac{1}{\sin 1+\ldots+\sin n}$$

3. A natural number n is given . Calculate:

$$\underbrace{\sqrt{2+\sqrt{2+\ldots+\sqrt{2}}}}_{n\ \text{корней}};$$

4. A natural number n is given . Calculate:

$$\frac{\cos 1}{\sin 1}\cdot\frac{\cos 1+\cos 2}{\sin 1+\sin 2}\cdot\ldots\cdot\frac{\cos 1+\ldots+\cos n}{\sin 1+\ldots+\sin n};$$

5. A natural number n is given . Calculate:

$$\sqrt{3 + \sqrt{6 + \ldots + \sqrt{3(n-1) + \sqrt{3n}}}}.$$

6. A natural number n is given . Calculate:

$$\frac{1}{a} + \frac{1}{a(a+1)} + \ldots + \frac{1}{a(a+1)\ldots(a+n)};$$

7. A natural number n is given . Calculate:

$$a(a+1)\ldots(a+n-1);$$

8. A natural number n is given . Calculate:

$$\frac{1}{a} + \frac{1}{a^2} + \frac{1}{a^4} + \ldots + \frac{1}{a^{2^n}};$$

9. A natural number n is given . Calculate:

$$a(a-n)(a-2n)\ldots(a-n^2).$$

10. Calculate:

$$(1 + \sin 0.1)(1 + \sin 0.2)\ldots(1 + \sin 10).$$

11. A real number x is given. Calculate:

$$x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!} - \frac{x^{11}}{11!} + \frac{x^{13}}{13!}.$$

12. Given real numbers x, a, natural number n . Calculate:

$$\underbrace{((\ldots((x+a)^2 + a)^2 + \ldots + a)^2 + a)^2 + a.}_{n \text{ скобок}}$$

13. A real number x is given. Calculate:

$$\frac{(x-2)(x-4)(x-8)\ldots(x-64)}{(x-1)(x-3)(x-7)\ldots(x-63)}.$$

14. Given a real number x, a natural number n . Calculate:

$$\sin x + \sin^2 x + \ldots + \sin^n x;$$

15. Given a real number x, a natural number n . Calculate:

$$\sin x + \sin x^2 + \ldots + \sin x^n;$$

16. Given a real number x, a natural number n . Calculate:

$$\sin x + \sin \sin x + \ldots + \underbrace{\sin \sin \ldots \sin x}_{n}.$$

17. Let

$$a_0 = 1; \quad a_k = k a_{k-1} + 1/k, \quad k = 1, 2, \ldots$$

Given a natural number n . Get a_n .

18 . Let

$$v_1 = v_2 = 0; \quad v_3 = 1.5;$$
$$v_i = \frac{i+1}{i^2+1} v_{i-1} - v_{i-2} v_{i-3}, \quad i = 4, 5, \ldots$$

Given a natural number n (n >=4). Get v_n .

19 . Let

$$x_0 = c; \quad x_1 = d;$$
$$x_k = q x_{k-1} + r x_{k-2} + b, \quad k = 2, 3, \ldots$$

Given real numbers q , r , b , c , d , natural number n (n >=2). Get x_n .

20 . Let

$$u_1 = u_2 = 0; \quad v_1 = v_2 = 1;$$
$$u_i = \frac{u_{i-1} - u_{i-2} v_{i-1} - v_{i-2}}{1 + u_{i-1}^2 + v_{i-1}^2}; \quad v_i = \frac{u_{i-1} - v_{i-1}}{|u_{i-2} + v_{i-1}| + 2}, \quad i = 3, 4, \ldots$$

Given a natural number n (n >=3). Get v_n .

21. Let

$$a_0 = a_1 = 1; \quad a_i = a_{i-2} + \frac{a_{i-1}}{2^{i-1}}, \quad i = 2, 3, \ldots \quad \Big|$$

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$$\Big| a_0 \cdot a_1 \cdot \ldots \cdot a_{14}.$$

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