

Lab 4. Functions

1. Real numbers s, t are given. Receive

$$f(t, -2s, 1.17) + f(2.2, t, s - t),$$

$$f(a, b, c) = \frac{2a - b - \sin c}{5 + |c|}.$$

2. Given real numbers s, t . Receive

$$g(1.2, s) + g(t, s) - g(2s - 1, st),$$

$$g(a, b) = \frac{a^2 + b^2}{a^2 + 2ab + 3b^2 + 4}.$$

3. Given a real number y . Receive

$$\frac{1.7t(0.25) + 2t(1 + y)}{6 - t(y^2 - 1)}, \quad \text{где} \quad t(x) = \frac{\sum_{k=0}^{10} \frac{x^{2k+1}}{(2k+1)!}}{\sum_{k=0}^{10} \frac{x^{2k}}{(2k)!}}.$$

4. Real numbers a, b, c are given. Receive

$$\frac{\max(a, a + b) + \max(a, b + c)}{1 + \max(a + bc, 1, 15)}.$$

5. Real numbers a, c are given. Receive

$$u = \min(a, b), \quad v = \min(ab, a + b), \quad \min(u + v^2, 3.14).$$

6. Given natural numbers n, m , integers

$$a_1, \dots, a_n, b_1, \dots, b_m, c_1, \dots, c_{30}.$$

Receive

$$l = \begin{cases} \min(b_1, \dots, b_m) + \min(c_1, \dots, c_{30}) \\ \text{при } |\min(a_1, \dots, a_n)| > 10, \\ 1 + (\max(c_1, \dots, c_{30}))^2 \text{ в противном случае.} \end{cases}$$

7. Given a natural number n , real numbers x, y , and $b_n, a_{n-1}, b_{n-1}, \dots, a_0, b_0$. Calculate the value of a polynomial with complex coefficients using Horner's scheme

$$(a_n + ib_n)(x + iy)^n + (a_{n-1} + ib_{n-1})(x + iy)^{n-1} + \dots + (a_0 + ib_0).$$

Determine the procedure for performing arithmetic operations on complex numbers.

8. Real numbers $u_1, u_2, v_1, v_2, w_1, w_2$ are given. Receive

$$2u + \frac{3uw}{2+w-v} - 7,$$

where u, v, w are complex numbers $u_1 + iu_2, v_1 + iv_2, w_1 + iw_2$. Determine the procedure for performing arithmetic operations on complex numbers.

9. Given a natural number n, a_1, \dots, a_n . Consider segments of the sequence a_1, \dots, a_n (under sequences of successive members), consisting of

a) full squares;

b) powers of five;

c) prime numbers. In each case, obtain the largest of the lengths of the considered segments. Determine procedures to recognize perfect squares, powers of five, prime numbers.

10. A natural number n is given. Among the numbers $1, 2, \dots, n$ find all those that can be represented as the sum of the squares of two natural numbers. Determine a procedure for recognizing perfect squares.

11. A natural number is called perfect if it is equal to the sum of its divisors, excluding itself. The number 6 is perfect, since $6=1+2+3$. The number 8 is not perfect, since 8 is not equal to $1+2+4$. Given a natural number n . Get all perfect numbers less than n .

12. Calculate:

$$\sum_{i=1}^{100} \sum_{j=1}^{50} \frac{1}{i+j^2};$$

13. Calculate:

$$\sum_{i=1}^{100} \sum_{j=1}^{60} \sin(i^3 + j^4);$$

14. Calculate:

$$\sum_{i=1}^{100} \sum_{j=i}^{100} \frac{j-i+1}{i+j};$$

15. Calculate:

$$\sum_{i=1}^{100} \sum_{j=1}^i \frac{1}{2j+i}.$$

16. A natural number n is given. Calculate:

$$\sum_{k=1}^n k(k+1) \dots k^2;$$

17. A natural number n is given. Calculate:

$$\sum_{k=1}^n \frac{1}{(k^2)!};$$

18. A natural number n is given. Calculate:

$$\sum_{k=1}^n (-1)^k (2k^2 + 1)!.$$

19. A natural number n is given. Calculate:

$$\sum_{i=1}^n \frac{(2i)! + |x|}{(i^2)!};$$

20. A natural number n is given. Calculate:

$$\frac{1}{n!} \sum_{k=1}^n (-1)^k \frac{x^k}{(k!+1)!};$$

21. A natural number n is given. Calculate:

$$\sum_{k=1}^n \sum_{m=k}^n \frac{x+k}{m}.$$

22. A natural number n is given. Calculate:

$$\sum_{i=1}^n \frac{(2i)! + |x|}{(i^2)!};$$

23. Given real numbers s, t . Receive

$$h(s,\,t)+\max(h^2(s-t,\,st),\,\,h^4(s-t,\,s+t))+h(1,\,1),$$

$$h(a,\,b)=\frac{a}{1+b^2}+\frac{b}{1+a^2}-(a-b)^3.$$