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

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

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

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

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

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

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,… , a_n. Consider segments of the sequence a_1,…, 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, ..., 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:

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

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

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

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