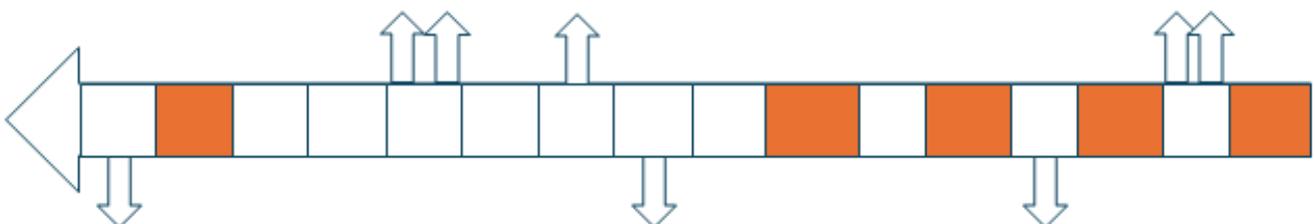




Problem 1. «Where to meet?»

Alice discovered an encrypted message sent by Bob, along with a few hints. Using these hints, she was able to decrypt it immediately. What was the original message?

Encrypted message: vkbkxoqebbktpdvt





Problem 2. «Crypto growth»

One old, experienced cryptographer told his young student: «You can't live without this function. Really, I believe you'll recognize it anywhere.»

Do you?





Problem 3. «Key for the 2025»

The cipher key is defined by the positive integers $a, b, c, d, e, f, g, h, i$, such that the following relation holds:

$$a^3 + b^3 + c^3 + d^3 + e^3 + f^3 + g^3 + h^3 + i^3 = 2025^{2026}.$$

Please, find the key!



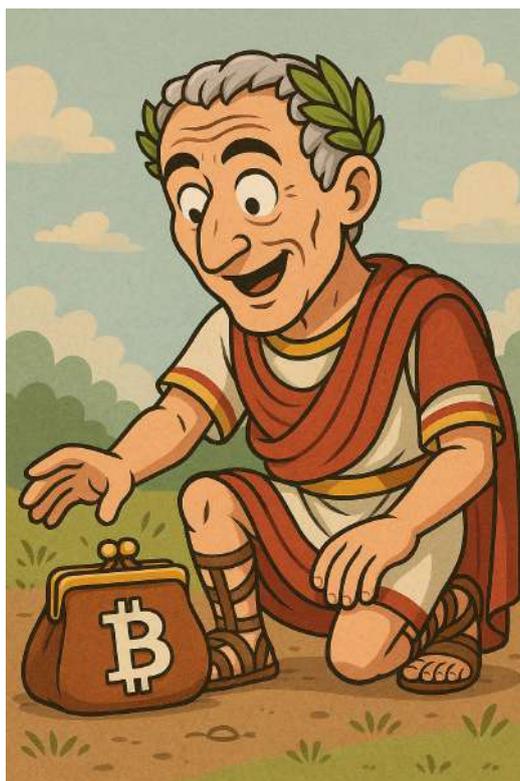


Problem 4. «Password to coins»

A famous Roman found a wallet with coins during his morning walk. To open it, he needs to enter a password hidden in the following line:

```
5655555556f012346789abcde5f012346789abcde5f012346789abcde5f012346789
abcde5555555558d6ac5b6c8c8bec8b8c7cec5c9b4b3c8cab8c7cec5c9b47657f607
18293a4bcde56789abcde5f01234f60718293a4bcde56789abcde5f0123444444444
56f57a7b5555555556ecbfe699badb4c3aaff8e4529b553cd616e459a11057a82ddf
155555555
```

Help Julius to get the password and take 5 coins from the wallet.





Problem 5. «A Greek cipher»

To encrypt the three-letter message we did the following. We matched each letter with it's numeric equivalent according to the table, and got p_1, p_2, p_3 .

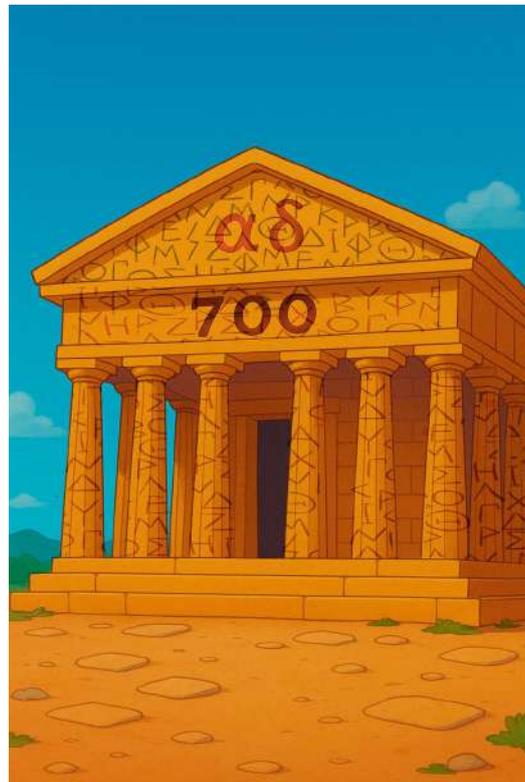
0	1	2	3	4	5	6	7	8	9
□	A	B	C	D	E	F	G	H	I
10	11	12	13	14	15	16	17	18	19
J	K	L	M	N	O	P	Q	R	S
20	21	22	23	24	25	26			
T	U	V	W	X	Y	Z			

Then we chose secret natural number δ and formed $p_4 = p_1 + p_2 + p_3 + \delta$. After that we chose another secret natural number α and calculated for $i = 1, 2, 3, 4$

$$c_i = p_i + 2p_{i+1} + (-1)^{\frac{i+1}{2}} \cdot \delta \pmod{27}, \text{ if } i \text{ is odd,}$$

$$c_i = p_{i-1} + p_i + (-1)^{\frac{i}{2}} \cdot \alpha \pmod{27}, \text{ if } i \text{ is even.}$$

As a result we have got: «WGAD». Recover the secret message.





Problem 6. «Toy cipher cryptanalyst»

Bob is a beginner in cryptography and, for fun, he makes cryptanalysis for toy versions of various ciphers. One of his functions written in C++ is below.

```
uint32_t foo(uint32_t x) {
    uint32_t y = 0x20000000;
    for (uint32_t i = 0x40000000; i != 0x80000000; ++i) {
        if (x == y)
            return i;
        y = y + ((i << 2) >> 1) + (i >> 30) + 1;
        y = ((y << 1) >> 1) + (y >> 31);
    }
    return 0x80000000;
}
```

What is the purpose of this function? Is there anything that needs to be fixed in this function? Please provide as many details as possible in your answers.

