A. Vishnu and Ameesha

2 s., 64 MB

So here is a secret: there are two remarkable devices hidden on campus - Machine A and Machine B. These machines have a unique reputation among the students for helping them win over their significant others. Machine A is located in Sky Lawn, while Machine B is hidden in a secluded corner of the music department.

Machine A is known for its romantic abilities. It grants you $2x+1$ love tokens if you insert x love tokens, each representing a heartfelt gesture or favor for your significant other. On the other hand, Machine B, the secret of the lovestruck students, is rumored to be even more generous. It yields $2x+2$ love tokens in return, making it the go-to choice for those deeply in love. Note that whenever you insert love tokens, you must insert all the tokens you have at that point in time.

Vishnu is deeply in love with his girlfriend Ameesha. He has asked her out for prom night, but he has run out of love tokens to make it truly magical. He has zero love tokens currently. He needs to figure out how to use the enchanting machines A and B to accumulate exactly n love tokens. Only by doing so can he hope to skore (not a typo).

The clock is ticking, and Vishnu needs to devise a heartfelt strategy to reach his romantic goal. Can you help him make this prom night an extraordinary and memorable one for his girlfriend?

Input

The input consists of a single line containing n $(1 \le n \le 10^9)$.

Output

Vishnu, to make his anniversary unforgettable, wants to create a sequence of A's and B's to accumulate love tokens. Output a string of A's and B's which represents the order in which the devices need to be used.

input
```
7
```
output
```
AAA
```

input
```
10
```
output
```
ABB
```

B. El Cardenal and his assistant

2.0 s, 256 megabytes

Pedro lives in Mexico City. But he is better known by a different name - El Cardenal, the priest. He leads a highly renowned cult in the city, known as the Stonephilia Cult. Everyone in the city aspires to become a part of it. Due to such high demand, he has established a unique criteria for people to be a part of his cult.

He requires them to present him with a rock, but not just any rock. He demands a rock that can be broken to obtain exactly three 'precious fragments'.

Each rock is represented as a binary string. A 'precious fragment' is symbolized by an exponent of two $(2^i, i \ge 0)$. A rock can yield 'k' 'precious fragments' if there exists a combination of 'k' 'precious fragments', such that the sum of their values equals the decimal integer value of the binary string. Note that it is not necessary for the values of the 'precious fragments' to be unique.

As El Cardenal's assistant, your task is to determine who can qualify for cult membership. Given a binary string representing a rock, your job is to determine if this rock can indeed be broken to obtain exactly three 'precious fragments'. If it's possible, print YES; otherwise, print NO.

Input

The first line contains one integer t $(1 \le t \le 10000)$ — the number of test cases.

The first and only line of each testcase contains a binary string of length N $(1 \le N \le 10^3)$, representing a rock.

Output

Print YES if it's possible to break the rock to obtain three pure stones, and NO otherwise.

You may print every letter in any case you want (so, for example, the strings yEs, yes, Yes and YES will all be recognized as positive answers).

input
```
4
10101
110000
0001
0
```
output
```
YES
YES
NO
NO
```

testcase 1: we can choose the three 'precious fragments' as 2^0, 2^2 and 2^4.

testcase 2: we can choose all the three 'precious fragments' as 2^4.

testcase 3: it is impossible to obtain three 'precious fragments' from the given binary string.

C. Ritvik and Subham

2.5 s, 256 MB

Ritvik was once walking to his room in Ashok Bhawan after brainstorming on the topic of diophantine equations with his friend Subham back in Ram Bhawan. When he reached his room, he found he had left the keys to his room at Subham's room. Ritvik, an extermely lazy fat guy, had no intention to walk back to Ram Bhawan to get the keys, so he asked if Subham can come to his hostel and give him the keys. Subham, being extremely busy with a task, did not wanted to leave the work to give him the keys, nor did Ritvik had any intention to walk this long.

Subham knew if he wanted to make a fat lazy guy like Ritvik walk, he must challenge him to do something, which if he lost, only then he would walk back. So, he talked out Ritvik and they agreed to call another mutual friend, Madhav to give them a question, and whoever solved it last would have to walk all way round for the keys. So, after thinking a lot, Madhav came up with a question.

He said I want to know for each test case, the least composite number which have at least n prime numbers before them, for each n in the test case. Both of them, started working on the problem, but Subham realised he had a lot work given to him by the seniors and had to leave urgently. Before leaving, relying completely upon you, he asked you to solve the question for him.

Help Subham to solve the problem before Ritvik, and make Ritvik burn some calories.

Please use PyPy compiler if using Python.

Input

The first line contains integer $T (1 \le T \le 10^5)$ – the number of test cases.

The first line of each test case contains integer $N (1 \le N \le 10^5)$ – the number of primes before smallest composite number for each test case.

The sum of N over all test cases does not exceed 10^8.

Output

Print the answer, in a new line for each test case.

input

```
5
3
5
7
9
12
```

output

```
6
12
18
24
38
```

D. Ritvik and Pizza

1 s., 256 MB

Ritvik has decided to eat a pizza at looters today. The pizza comes with a virtually infinite supply of both chilli flakes and oregano seasoning. However, being a foodie, he wants to add the optimum level of spice, S, to the pizza.

Through careful calculations, Ritvik has determined that the spice level added to the pizza by a packet of chilli flakes is x and the spice level added by a packet of oregano seasoning is y. To avoid wastage, he refuses to throw away a partially used packet of either type of seasoning.

Determine how many total packets of seasoning, q, Ritvik needs to satisfy his palate by reaching the optimum spice level, S. If there are multiple ways, print the minimum value of q. If it is impossible, print -1.

Input

The first line contains a single integer T $(1 \le T \le 3 \cdot 10^5)$, the number of testcases.

The first and only line of each testcase contains three space-separated integers, S $(0 \le S \le 10^9)$, x $(0 \le x \le 10^9)$, and y $(0 \le y \le 10^9)$, the optimal spice level, the spice level of a packet of chilli flakes, and the spice level of a packet of oregano seasoning respectively.

Output

For each testcase, output a single line containing q, the total number of packets of seasoning Ritvik needs to use. If it is impossible, print -1.

input

```
3
5 2 3
5 4 6
8 2 1
```

output

```
2
-1
4
```

Testcase 1: $5 = 1 \cdot 2 + 1 \cdot 3$

Testcase 2: It is impossible to satisfy the requirements.

Testcase 3: $8 = 4 \cdot 2 + 0 \cdot 1$

E. Subham hates DD Labs

1 s., 256 MB

Breadboards come in different sizes. (Google breadboard and take a look at its image if you don't know what it is). Say a breadboad is of size $n \times m$. Subham matched each hole of a breadboard to a non-negative integer. Thus in this question, the breadboard can be considered to be a matrix, M, of size $n \times m$, consisting of non-negative integers.

Subham wants to make the PERFECT breadboard. Subham considers that the breadboard is PERFECT, if for each submatrix A of size 4×4 of the matrix M is true:

- $A_{11} \oplus A_{12} \oplus A_{21} \oplus A_{22} = A_{33} \oplus A_{34} \oplus A_{43} \oplus A_{44}$,
- $A_{13} \oplus A_{14} \oplus A_{23} \oplus A_{24} = A_{31} \oplus A_{32} \oplus A_{41} \oplus A_{42}$,

where $\oplus$ means bitwise exclusive OR

Subham asks you to help him make the PERFECT breadboard, and the breadboard should have as many different 'types of holes' as possible!

The two integers n and m are given to you.

You have to generate a matrix M of size $n \times m$, which should be a PERFECT breadboard, AND in which the number of different numbers is maximized.

Input

The first line of input data contains one integer number t $(1 \le t \le 1000)$ — the number of test cases.

The single line of each test case contains two integers n and m $(4 \le n,\ m \le 200)$ — the size of matrix M.

It is guaranteed that the sum of $n \cdot m$ does not exceed $2 \cdot 10^5$.

Output

For each test case, in first line output one integer $count$ $(1 \le count \le n \cdot m)$ — the maximum number of different numbers in the matrix.

Then output the matrix M $(0 \le M_{ij} < 2^{63})$ of size $n \times m$. If there are several correct matrices, it is allowed to output any one.

It can be shown that if there exists a matrix with an optimal number of distinct numbers, then there exists among suitable matrices such a M that $(0 \le M_{ij} < 2^{63})$.

input

```
4
5 5
4 4
4 6
6 6
```

output

```
25
9740 1549 9744 1553 9748
1550 1551 1554 1555 1558
10252 2061 10256 2065 10260
2062 2063 2066 2067 2070
10764 2573 10768 2577 10772
16
3108 3109 3112 3113
3110 3111 3114 3115
3620 3621 3624 3625
3622 3623 3626 3627
24
548 549 552 553 556 557
550 551 554 555 558 559
1060 1061 1064 1065 1068 1069
1062 1063 1066 1067 1070 1071
36
25800 25801 25804 25805 25808 25809
25802 4294993099 25806 4294993103 25810 4294993107
26312 26313 26316 26317 26320 26321
26314 4294993611 26318 4294993615 26322 4294993619
26824 26825 26828 26829 26832 26833
26826 4294994123 26830 4294994127 26834 4294994131
```

In the first test case, there is only 4 submatrix of size 4×4. Consider a submatrix whose upper-left corner coincides with the upper-left corner of the matrix M:

$$\begin{bmatrix} 9740 & 1549 & 9744 & 1553 \\ 1550 & 1551 & 1554 & 1555 \\ 10252 & 2061 & 10256 & 2065 \\ 2062 & 2063 & 2066 & 2067 \end{bmatrix}$$

$9740 \oplus 1549 \oplus 1550 \oplus 1551 = 10256 \oplus 2065 \oplus 2066 \oplus 2067 = 8192$;

$10252 \oplus 2061 \oplus 2062 \oplus 2063 = 9744 \oplus 1553 \oplus 1554 \oplus 1555 = 8192$.

So, chosen submatrix fits the condition. Similarly, you can make sure that the other three submatrices also fit the condition.

F. Easy Diophantine ??

2.0 s, 256 megabytes

Number of ordered triplets (x, y, z) satisfying

$$Ax\ +\ By\ +\ Cz\ =\ S$$

such that $0\ \leq x,\ y,\ z\ \leq\ N$

$N,\ A,\ B,\ C,\ S,\ x,\ y$ and z are integers.

Input

The first and the ONLY line contains 5 spaced integers in the form $N\ \ A\ \ B\ \ C\ \ S$

$0 \leq N \leq 10^6$

$0 \leq A, B, C \leq 10^9$

$0 \leq S \leq 3 \times 10^{15}$

Output

Print one integer denoting the number of solutions to the equation.

input
```
5 3 1 5 15
```
output
```
7
```

input
```
1 1 1 1 1
```
output
```
3
```

input
```
100000 31415 92653 58979 1000000000
```
output
```
2897
```

input
```
1 2 3 4 5
```
output
```
1
```

input
```
1000000 165613875 701151656 947037805 85081109851091
```
output
```
34
```

input
```
1000000 989884871 349334247 653534982 1968372528321105
```
output
```
1
```

input
```
1000000 636 133 744 640089113
```
output
```
1212055019
```

input
```
1000000 379609296 111151265 502827673 975575808694275
```
output
```
8
```

input
```
1000000 606898080 799371447 476754823 203838696608742
```
output
```
88
```

input
```
1000000 311719417 676370863 443096666 419167624344763
```
output
```
881
```

input
```
1000000 614506827 310816863 751921105 796926213197711
```
output
```
1262
```