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Intermediate Questions

Level 1

Question 1:

Create a function that finds all **prime numbers** in a **list** and returns them as a **set**.

Input:

```
list = [7458, 7501, 8443, 7907, 6977, 1264, 9272, 7269, 3814, 2455, 1970,
2288, 4614, 9718, 6523, 1631, 3631, 7023, 8101, 4201, 7261, 6448, 5611, 7907,
1953, 9959, 7499, 9256, 4684, 4071, 1621, 4510, 1509, 1810, 6660, 2507, 8566,
5466, 2939, 6516, 7238, 1813, 8567, 2548, 9779, 1556, 6753, 7321, 6049, 6395]
```

Question 2:

Create a function that takes a **list** and returns a new **list** whereby all **even** numbers come before all **odd** numbers (no need to arrange in ascending order).

```
list = [6345, 8879, 6505, 4771, 2114, 1285, 1508, 1495, 2361, 8895, 3561,
6401, 8215, 8389, 7153, 6159, 6009, 7319, 5065, 4462, 1239, 2049, 2021, 3178,
4799, 6062, 7111, 4457, 6188, 3426, 9836, 5819, 3512, 6558, 4624, 2147, 6464,
4660, 6356, 7926, 7623, 5072, 2527, 9114, 8543, 5712, 3829, 6133, 9012, 9539]
```

Question 3:

Create a function that takes a **string** and returns the **number of words** in that string (a 'word' is defined by any character separated by 'punctuation')

```
punctuation = [' ', ',', '.', '!', '?', '-']
```

Input:

```
string1 = "AH-pateu apateu, apateu apateu, apateu apateu, ugh, ahah
ahah!"
```

Question 4:

Create a function that removes duplicates in a **list** and returns it as a new **list**.

Input:

```
List = [80942, 56301, 31458, 33949, 66355, 38743, 75119, 83391, 93763, 74128,
22457, 34728, 12229, 84762, 74128, 74128, 34225, 88818, 47599, 46639, 19287,
```

22457, 22902, 74128, 88818, 36443, 35746, 84289, 33949, 35746]

Level 2

Question 1:

Scenario: A **STEM awareness campaign** wants to generate **unique hashtags** based on the initials of **notable women in STEM**. A campaign focuses on **Marie Curie (Physics & Chemistry)**, **Ada Lovelace (Computer Science)**, and **Rosalind Franklin (Biology)**.

They use their initials (**mar**) to generate **unique permutations** for hashtag variations:

- **mar, mra, amr, arm, rma, ram**

Problem Statement:

Given a string **S** ($1 \leq |S| \leq 8$), consisting of lowercase letters, representing the initials of STEM pioneers, print all unique permutations in lexicographical (alphabetical) order, one per line.

Sample Input:

mar

Sample Output:

amr
arm
mar
mra
ram
rma

Your Input: ada

Question 2:

A company wants to standardize a set of numerical values by adjusting them to a common target in the most cost-efficient way. The cost of adjusting a value is the absolute difference between the original and new value.

Given an array of **N** values, determine the minimum total adjustment cost required to make all values equal.

The first line contains an integer **N** ($1 \leq N \leq 100,000$), the number of values.

The second line contains an array of **N** integers **A**₁, **A**₂, ..., **A**_N ($-1,000,000 \leq A_i \leq 1,000,000$), representing the values.

Output a single integer representing the minimum total cost to make all values equal.

Sample Input:

```
5
50000 52000 54000 70000 75000
```

Sample Output:

```
43000
```

Explanation:

1. Sort the values: 50000, 52000, 54000, 70000, 75000
2. Choose the median value: 54000
3. Compute the adjustment cost:
 - Adjust 50000 → 54000 (+4000)
 - Adjust 52000 → 54000 (+2000)
 - 54000 stays the same (0)
 - Adjust 70000 → 54000 (-16000)
 - Adjust 75000 → 54000 (-21000)
4. Total cost = 43000

Find the minimum total adjustment cost for the following input:

```
6
55000 60000 62000 75000 80000 50000
```

Question 3:

You are tasked with simulating the growth of a population of bacteria in a controlled environment. Your goal is to create a program that models the increase in the bacterial population over a specified number of days.

The bacteria multiply based on a given growth rate, and the simulation should track the total population size each day.

You are given 3 numbers:

- The first integer, b , is the initial number of bacteria.
- The second integer, m , is the maximum carrying capacity of the environment.
- The float, r , is the growth rate—a float between 0 and 1, representing the fraction of the current bacterial population that multiplies each day.

You should return an answer that is the days until the population reaches or exceeds the carrying capacity.

Sample Input and Output
Input: $b = 10$ $m = 1000$ $r = 0.2$ Output: 26 Explanation: Day 1: $10 \rightarrow 10 + (10 * 0.2) = 12$ Day 2: $12 \rightarrow 12 + (12 * 0.2) = 14.4$... Day 26: Population reaches or exceeds 1000

Output the number of days for the following input:
Input: $b = 1000.076893438$ $m = 7897654345678965345678907654323456789876534567432345698767890987.987678$ $r = 0.3758938726$

Question 4:

You are a cybersecurity specialist attempting to infiltrate a highly secure data center. The only way to gain access is by sending a data packet through a closed-loop network of servers.

A terminal displays a challenge:

“This network of servers is configured in a circular topology. To break through the firewall, your data packet must traverse the network n times, collecting information from each server in the process.”

Write a Python function `transmit_data` that takes a list `network` (of integers, representing data values stored on each server) and an integer n (the number of times the packet must cycle through the network). The function should return the sum of all collected data values after completing n full cycles.

Sample Input and Output

Input:

`a = [3, 7, 2, 5]`

`n = 2`

Output:

`34`

Explanation:

One full cycle: $3 + 7 + 2 + 5 = 17$

Two full cycles: $17 \times 2 = 34$

Find the output for the following input:

Input:

`a = [-50, -43, 49, 4, 49, -39, -30, 13, 18, 28, 5, -21, -37, 11, 14, -41, 27, 45, 45, 23, -45, 50, -30, -13, 47, 16, -17, 50, 21, -29, 13, -39, 25, -36, 0, -21, -30, -15, 47, -31, 10, 31, -8, -14, 31, -49, -27, -38, -11, 19, -31, 14, -28, 24, 49, 5, 13, -16, 50, -30, -14, 0, 23, -31, 47, -42, 12, -12, -20, -43, 33, 27, -37, -38, -44, 35, 36, 5, -11, 2, 6, -31, 37, -33, 8, -46, 36, -45, 31, 48, -37, -44, 10, -38, 42, -50, 31, -40, 39, -17, -37, 9, -34, -22, 46, -50, -3, 7, 34, -40, -37, 32, -9, -34, 9, 18, 14, 4, 12, -23, -26, 4, -23, 40, 28, -8, 17, -41, -31, -47, -45, -34, -23, -35, -27, 47, -30, -26, -38, 5, 41, 44, 35, -14, -5, -33, -13, 12, -46, 45, 35, 25, -10, 22, 20, 49, -34, 37, 27, -17, -8, 27, -12, 8, 50, -6, -32, 24, -36, -34, -31, -38, 38, 50, -47, 13, 16, 1, -31, -6, -33, 5, 3, -40, -35, -12, 24, -23, 2, -4, -33, 31, -26, 31, -7, 5, 12, 10, 39, -29, 49, -22, -4, -37, 0, 40, 23, 21, 8, -38, -26, -50, -24, -40, 33, -16, -7, 15, -47, -43, -12, 46, 26, -25, 35, -19, -12, 1, 21]`

$n = 215$

Question 5 (Please skip this question as there is a mistake)

You have obtained two lists $\mathbf{a}$ and $\mathbf{b}$, containing n and m elements respectively. For each integer i from 1 to n , you may choose an integer j such that $1 \leq j \leq m$ and set $a_i := b_j - a_i$ at most once. It is possible for a_i to become non-positive as a result of this operation. Determine whether $\mathbf{a}$ can be sorted in non-decreasing order.

Input

The first line contains an integer t — the number of test cases.

The first line of each test case contains one integer n .

The following line of each test case contains n integers $a_1, a_2, \dots, a_n$

The following line of each test case contains one integer b

Output

For each test case, print “YES” on a new line if it is possible to sort $\mathbf{a}$ in non-decreasing order. Otherwise, print “NO” on a new line.

Sample Input	Sample Output
5	YES
1 1	NO
5	YES
9	NO
3 1	YES
1 4 3	
3	
4 1	
1 4 2 5	
6	
4 1	
5 4 10 5	
4	
3 1	
9 8 7	
8	

Explanation

In the first test case, [5] is already sorted.

In the second test case, it can be shown that it is impossible.

In the third test case, we can set $a_3 := b_i - a_3 = 6 - 2 = 4$. The sequence [1, 4, 4, 5] is in nondecreasing order.

In the last case, we can apply operations on each index. The sequence becomes $[-1, 0, 1]$ which is in nondecreasing order.

Find the output for the following input:

```
18
8 1
40 10 50 39 12 41 7 51
39
1 1
59
4
2 1
15 14
89
9 1
64 75 9 49 79 94 89 18 16
87
10 1
47 134 194 282 368 459 545 571 645 739
96
4 1
18 77 53 29
50
6 1
76 106 116 188 223 239
91
5 1
72 47 25 11 76
68
3 1
99 17 98
84
7 1
1 9 14 17 22 29 30
10
5 1
84 77 90 64 13
7
6 1
58 75 97 123 139 139
28
5 1
37 89 111 192 235
99
5 1
23 44 54 48 21
42
7 1
```

```
1 1 3 15 25 39 47
15
9 1
30 93 89 72 75 83 83 62 85
23
7 1
89 33 24 23 42 48 99
19
4 1
12 21 88 46
75
```

Question 6:

Given a string `s`, return the longest palindromic substring in `s`.

Input: A string `s`

Output: The longest palindromic substring in `s`

Example:

- **Input:** "babad"
- **Output:** "bab"

Note: "aba" is also a valid answer.

Input:

"jfkwegedagedigedagedaogieigosoidirijfgudfidhvsieuggfmfdhcvosdjewfspisdoesuvbohairkcese
nzechousuhdbubakdutudvjbdseuhgbdszkutudibygjbdseugoweioiefegoweioiebiofeabebaooeirhkfo
wiegoodluckyallbfhmfoqielwrboeirhkfowiebfhmfoqielsihghilsjfiworiflskfhggiwueebfndjigppaabcd
efghihisjfievjfpojojvjfpowfuohwgirls codedocslrigajojgijriowoifnvkrirhshreifpsjdgjdlskfjb"

Question 7:

A GIC researcher has bred a new species called the **alomomofa**, which multiplies at an incredibly fast rate. Each alomomofa can breed 3 more alomomofa every minute. The GIC researcher is working on a solution to stop them from multiplying, but she needs to know the total number of alomomofa after n minutes to determine how much of the solution to use to reduce the population back to 1. The alomomofa multiply in the following way:

- Initially, with 1 alomomofa, it breeds 3 more every minute
- When there are 20 alomomofa, they will merge into one **alomomoja**

Given that alomomoja are unable to reproduce, help the GIC scientist find out how many alomomofa will be present after n minutes if the initial number of alomomofa is 1.

Input Format

A single integer n , representing the number of minutes.

Output Format

The first line should contain the total number of alomomofa after n minutes.

The second line should contain the total number of alomomoja after n minutes.

Sample Input	Sample Output
3	4 3

Explanation

After 1 minute, there will be $1 + 3 = 4$ alomomofa.

After 2 minutes, the total number of alomomofa will be $4 + 3 + 3 + 3 + 3 = 16$.

After 3 minutes, there will be $16 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 = 64$ alomomofa. Every 20 alomomofa will merge to form 1 alomomoja, so there will be 4 alomomofa and 3 alomomoja remaining.

Find the output for the following input:
10000000