CyberChallenge.IT 2024
Programming Test

Subset Count [100 points]

Problem Statement

Alan Alright, guys, today we'll delve into the fascinating realm of public-key cryptography!

Bob Public key?! So, we just throw our passwords out there for everyone to see?

Alan ...not quite, Bob. But you're on the right track. In public-key cryptography, we share certain information publicly while keeping the rest private...

Charlie Oh, I get it! It's that thing where we can multiply numbers together, and then it's a real pain to figure out the original numbers!

Alan You've got the gist of it, Charlie. In public-key cryptography, we utilize one-way functions: mathematical problems that are easy to compute but challenging to reverse. It's like creating a maze: simple to design if you know the path, tricky to navigate backward.

Charlie That's what I said, isn't it?

Alan Of course factorization is one example of a hard problem, but there are many more: discrete logarithms, knapsack problems, learning with errors, solving multivariate systems...

Bob interrupts abruptly

Bob If there are so many, can't I just create my own?

Alan No, Bob, that's not how it works...

Bob Wait, hear me out! I give you a big set S of distinct positive integers and a number D. Then, I choose two subsets A and B of S with no elements in common. But here's the twist: if you pick any two numbers in the same subset (either A or B), their difference (in absolute value) won't be greater than D! I bet that given S and D, you can't compute the maximum of the sum of the number of elements of A and the number of elements of B!

Alan This doesn't even make sense, Bob...

Bob Can you compute this number or not?

Alan is left speechless...

Problem Details

Input

The input consists of $2T + 1$ lines:

- Line 1: the number of testcases T
- Lines $2, \ldots, 2T + 1$: every group of 2 lines is formatted as follows
  - Line 1: two space separated integers, N (the size of the set S) and the number D
  - Line 2: N space-separated integers, representing the set S

Output

The output consists of T lines, each representing the answer to the corresponding testcase.

Scoring

Your program will be tested on a number of testcases grouped in subtasks. In order to obtain the score associated to a subtask, you need to correctly solve all its testcases.

- **Subtask 1** [**30 points**]: $1 \leq T \leq 20, 1 \leq N \leq 500, 1 \leq D \leq 250$
- **Subtask 2** [**30 points**]: $1 \leq T \leq 20, 1 \leq N \leq 10000, 1 \leq D \leq 5000$
- **Subtask 3** [**40 points**]: $1 \leq T \leq 20, 1 \leq N \leq 100000, 1 \leq D \leq 50000$

For each testcase, every entry of the array S is a positive integer not exceeding 2^{60}.

Examples

INPUT	OUTPUT
3 11 500 1598 2672 660 1864 1672 2942 1075 4744 3685 2893 2777 15 100 278 3176 4710 1836 777 3152 584 4548 1126 2195 3482 3945 4201 1556 3140 10 10 431 4202 2861 4287 2514 3694 4068 3125 2083 3434	7 4 2

Explanation

In the first testcase, we can construct the sets as follows: $A = \{2672, 2942, 2893, 2777\}$, $B = \{1598, 1864, 1672\}$, for a total of $4 + 3 = 7$ elements.

In the second one, a possibility for the sets is: $A = \{3176, 3152, 3140\}$, $B = \{278\}$, for a total of 4 elements.

In the third testcase, there are no elements with difference less or equal to 10, so we can pick any pair of numbers and create two one-element sets, resulting in 2 total elements.