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Advanced Questions

Question 1

You have two strings, A and B, each of length N. Both strings contain only the characters 'G' and 'H'. Your task is to make B identical to A by flipping sections of B.

A flip means choosing a consecutive substring in B and swapping all 'G' and 'H' within that section (i.e., every 'G' becomes 'H' and vice versa).

Output the minimum number of flips required to make B match A.

The first line of input contains N, and the next two lines contain the strings A and B.

Sample Input:

```
7
GHHHGHH
GGHHHGG
```

Sample Output:

```
2
```

Explanation:

Flip the first character in B → "GHGGGHH"

Flip the third and fourth characters → "GHHHGHH" (now B matches A)

Input
Case 1: 1000 GHHHHGHHHHGHHGHGGGHHGGHGHGHHGGGHHHHGGHHHGGGGGGHGHGHHGGHHGH GHGHHGGHGHGGHHHGHGGHGHHHGHHHHHGHHHHHGGHHGGGGHHGHGHHGGG GHGHHGGHHGGGHGGGGGGGHHHHGGHHHHHHGHGHHHGGHGHGHHGHGGHH HGGHHHGGGGHHGGHGGGGGHHHHGHHHHHGGGGGHHHHHHGGHHGHHGGHGH HHGHGHGGHHGHGGGGHHGGGHGGGGGGGHHGGHHGGHGHGGGHGGHGHGHH HGHHGHHHGGHGHGGHHGGGHGHHGGHHHHGHGHHGGGGHHGGGHHGHHHGH GGGGGGGHHGHHGHGHHGGGGGHHGGGHGGHHGHGHHGGGGGHHGGHHHGHGHH GHGHHGHGGHHGHGHHGGHHHGGHHHGHHHGHGHHHHHGGHGGHGHHHHHG GGHGHGHGHHGGHHGHGHHGHGHHGGHGHGHHGGGGGGGGHGGGHGHHGHG GGHGGHHGHGGGGGGHGGHGHGHHHHHHGHGHHGHGHHGGGGGGHGGGGHHHH GGHHGGHGHHHGHGGGGGGHGGGGHGHGHHGGHGHGHHGGHHHHGGGGHGH

HHGHGGGGGHGHHHGHGGGGHGHGGHGGGHHHGHGGHHGGGGHGHGHHGGHH
GHHGGGGHGHGGHHHHHGHGHGGGGGGGGHGGHGHGGGGGGHGHGHHHGGG
GGGHGGHGGHGGGGHHHHHHGGHHGGHGHGGGGHGHGHHGGGGHGHGHHGGH
GHHGGGGHGHGHHGGHGGHGHGGGGHGHGGGGHGHGHHGGGGHGHGHHGGHGGG
HHHGHGHGHHHGGGGGHGGGHGHGGGGHGHGHHGGGGHGHGHHGGHGGG
GHHHHHHGHGHHHHHGGHHGGGGHGGGHGGHGHGHHHGGGGHGHGHHGGGG
GGHHHHHGGGGHGHGHHHHGGGGHGHGGHHGHGHHGGHGGHGHGHHGGGGHGG
HGHGGGGHGGGHHGGHGGGGHGGGGGGGGHGGGHHHHHGGGGGHHHHGHGGG
HGGHGH

GHHGHGHGHGHHGHGGGGHGGHHHGGHGGHHHGHGHHGHGGGGHGHGHHGGHGGH
GHGHHHGHGGGGHGHGHHGGHGGHGHGHHHGGHHGGGGHHHGHGHHGHGHHGGG
GGHHHHGHGHHGGGGGGGGGGHHHGHGGHHGHGHHGHGHHGHGHHHHGHGHHGG
HHGGGHHGGGHHHGHGGGGGHHHGHGHHHGHGHHGGHHHHHGGGGHGGHGHGHHH
GHHGGGGHGGHGGGGHGGGHGGHGGHGGGGHGGHGGHGHGHHGGHGGHGGH
HHGGHGHGHHGGGGHGGGHGGGHGGHGHGHHHHHGGGHHGHGHHGGGHGGHGHGHH
HHGGGGGHHHHGGHGHGHHGGGGGGGGHGGGHGHGHHGGGGGGHGHGHHGHHGH
HHGHGHHGHGHHGGGHHGGHGHGHHHGHGHHGGHGHGHHGHGGHHGHGGHHH
HGGGHGHGGGHHGGHGHGHHHGHGHHGGGGHGGGHHGGGGHGGGHGHGHHGH
GGGGHGGHGGGHGGGGGGGGHGHGHHHGGHHHGGHHHGGGGHGHGGHGH
HHHHHGHGHHHHHGGGGGGGGGGGGHGGHHHGHGHHHHHHHGGHGHG
HHGGHGGHGGHGGHGHGHHGGGGGGGGHGGGHGGGHHGGHGGGGHGHGHHHGGH
HGHGGHHGHGGGHHHGGGGHGHGHHGGGGHGGHHHGGHGGGGHGGGHHHGG
GGGGHGHGHHGGHGGHHHGHGGGGHGHGHHHGHGHHHGHGHHHGGGGHGGHGGH
HHHHGHGHGHHHGGGGHGHGHHGGGGHGGGGGGGGHGGHGGGGHGHGHHGGGHH
HGHGGHHHGHGHHGGGGHGGHGGGGHGHGGHHGGGGGGGGGGHGGHGGHGG
GGHGHGHHHHHGHGHHHGGHHGGGGHGGGHGGHGHGHHHGGGHHHGGHGHG
GGHHGHGHHGGGHGHGHHGGHGHGHHHGGHGGGGHGHGHHGGHGHGHHGGGHHH
HGHGHHGHGHHGGHGGGGHGGGGGGGGHGGHHHGHGHHGGGGHGHGHHHGH
HGGGHHH

Case 2:

900

HHGHGGGHHGGGGHGHGHHGGGGHGGHGGGGHGGGGHGGHGHGHHGHGHHGGHGG
GHHGGHGHGHHGHHHHHHHGHGGGHHHHHGHGGHHHGHGHHGHHGHHGHHGHH
HHGHGHGGGGHHHGGGGHGHGGGGHGHGHHHGGGGHGHGHHGGGHHHHHGHGHH
GHGGGHHHHGHGHHGGHGHGHHGHHGGGGHGGGGHGHGHHGGGGHGHGHHGHHG
GHHGHGHGHHGGGGHHHGHGHHGGHHHHHGGHGHGHHGGHHHHHHHGHGHHGHHG
GGHGHGHGHHHGHGHHHGGGGHGHGGHGHGHHGHHGGHHHGGGHHGHHHGGGGH
HHHGHGHHHGGGGHGHGHHGHHGHHGGHGHGHHGGGGHGGGGHGGHGGHGG
HHGGGGGGGGHGHGHHGGGGHGHGHHHGGHHHGHGHHGHHGHHGHHGHHGHHGGGG
HHGGGHHHGHGHHGGGGHGHGHHGHHGHHGHHGHHGHHGGGGHGHGHHGGGGH
GHHGGHGHGHHGHHGGGHHGHHGHHHGHGHHGHHGHHGGGGHGHGHHGGHGGH
GGGHGHGHHGGGHHGHGHHGHHGHHHGGHHHHHGHGGGGHGGHGHGGHGGHHH
HHGGHHGGGHHGHGGHGHGHHGGGGHHHGGGHHHGHGGHGHGHHGHHGHHGGH
GHGHHGHGHHHGHGGGGHGGGGHGHGHHGHHGHHHGHGHHGGGGHGHGHHGGH
GGGHGHHHHGGHGGGGHGGHHHGGHHHGHGGHGHGHHGGGGHGGGGHGHGHHGG
HHGHHGGHGHGHHGGGGGGHHHGGHHGHGHHGGGGGGHHHGHGGGHGGHHH
HGGHGGGGHGHGGHGGHGGGGHGHGHHGGHGHGHHGGGGGGGGHGHGHHGGHGG
GHHGGGHHHGGHGGGGHGGGGHGGHGGGGHGHGHHGGGGGGHGHGHHGGHGGH
HGGGHGGGGHGHGHHGGGGHGGGGGGGGHGGHHHGHGHHGGGGHGHGHHHGH
HGGGHGGGGHGHGHHH

[illegible]

Question 2

A long straight wall needs to be painted, and two painters have been assigned the task. The first painter paints the interval between $x=a$ and $x=b$. For example, if $a=3$ and $b=5$, then the painter paints an interval of length 2. The other painter paints the interval from $x=c$ to $x=d$, which may possibly overlap with part or all of Farmer John's interval. Please determine the total length of fence that is now covered with paint.

The first line of the input contains the integers a and b , separated by a space ($a < b$).

The second line contains integers c and d , separated by a space ($c < d$).

The values of a , b , c , and d all lie in the range $0 \dots 100$, inclusive.

Please output a single line containing the total length of the fence covered with paint.

SAMPLE INPUT:

7 10

4 8

SAMPLE OUTPUT:

6

Input
Case 1: 52 76 23 52 Case 2: 10 72 33 72

Question 3

A scientist is experimenting with liquid mixtures using three containers of different capacities. Each container initially holds a certain amount of liquid, but they are not necessarily full. The scientist performs a sequence of transfers in a cyclic manner:

Pouring from container 1 into container 2

Pouring from container 2 into container 3

Pouring from container 3 into container 1

This process repeats for a total of 100 pours (so the 100th pour would be from container 1 into container 2). Each time, the scientist transfers as much liquid as possible from one container to the next, stopping when either the source container is empty or the destination container is full.

Your task is to determine how much liquid remains in each container after all 100 pours.

The first line of the input file contains two space-separated integers: the capacity c_1 of the first bucket, and the amount of milk m_1 in the first bucket. Both c_1 and m_1 are positive and at most 1 billion, with $c_1 \geq m_1$. The second and third lines are similar, containing capacities and milk amounts for the second and third buckets.

Please print three lines of output, giving the final amount of milk in each bucket, after 100 pour operations.

SAMPLE INPUT:

10 3

11 4

12 5

SAMPLE OUTPUT:

0

10

2

Input
Case 1: 695789 393585 705404 502652 999933 95061 Case 2: 855636227 749698587 687926653 660260757 959997302 485560281

Question 4

A driver is traveling along a straight 100-mile road, which is divided into N segments. Each segment has a specified length (in miles) and a speed limit (between 1 and 100 miles per hour). The total length of all segments adds up to exactly 100 miles.

The driver's journey is also divided into M segments, where each segment specifies how many miles they traveled and at what speed. The sum of all journey segments is also exactly 100 miles. The vehicle used can reach a maximum speed of 100 miles per hour.

Your task is to determine the maximum amount by which the driver exceeded the speed limit at any point during the journey.

Input format:

The first line of the input contains N and M , separated by a space.

The next N lines each contain two integers describing a road segment, giving its length and speed limit.

The next M lines each contain two integers describing a segment in the driver's journey, giving the length and also the speed at which the driver was driving.

Output format:

Please output a single line containing the maximum amount over the speed limit the driver drove during any part of the journey. If the driver never exceeds the speed limit, please output 0.

SAMPLE INPUT:

```
3 3
40 75
50 35
10 45
40 76
20 30
40 40
```

SAMPLE OUTPUT:

```
5
```

Input
Case 1: 50 50 1 35 2 74 2 44

1 36
1 4
1 39
4 98
1 78
1 65
2 58
1 26
2 91
1 53
1 87
2 69
1 72
3 5
2 59
7 75
1 44
1 54
5 99
1 25
1 76
3 43
2 42
4 15
1 14
2 44
2 59
1 17
1 51
1 55
4 30
2 51
1 91
2 3
1 32
4 66
3 49
2 34
4 31
2 97
2 20
2 87
3 90
1 74
1 48
2 71
2 24
1 50
3 54
2 30

1 4
3 19
6 42
1 12
2 95
1 43
6 1
2 2
2 8
1 66
1 70
2 23
1 68
2 44
3 42
1 78
3 3
2 22
1 15
1 20
2 17
1 10
2 10
1 7
1 14
1 33
2 9
4 11
2 24
2 21
3 31
2 2
5 15
1 30
1 25
3 40
1 18
4 22
1 54
2 8
1 69
1 57
2 22
2 61
3 19
1 12
1 32

Case 2:
100 100

1 57
1 14
1 37
1 100
1 69
1 19
1 97
1 74
1 66
1 98
1 77
1 38
1 4
1 97
1 39
1 74
1 51
1 72
1 68
1 62
1 66
1 26
1 65
1 10
1 99
1 1
1 91
1 59
1 59
1 96
1 19
1 66
1 8
1 50
1 69
1 17
1 57
1 57
1 32
1 57
1 10
1 52
1 67
1 28
1 77
1 43
1 27
1 40
1 76
1 34

1 81
1 63
1 56
1 80
1 37
1 17
1 9
1 14
1 15
1 46
1 11
1 97
1 37
1 64
1 37
1 80
1 73
1 81
1 43
1 77
1 96
1 37
1 57
1 14
1 95
1 47
1 90
1 15
1 30
1 92
1 99
1 26
1 38
1 56
1 25
1 77
1 7
1 35
1 88
1 11
1 62
1 71
1 56
1 26
1 34
1 16
1 63
1 37
1 82
1 88

1 67
1 8
1 29
1 3
1 48
1 13
1 69
1 19
1 7
1 18
1 55
1 27
1 1
1 22
1 5
1 50
1 19
1 36
1 40
1 34
1 14
1 4
1 16
1 8
1 18
1 1
1 72
1 46
1 43
1 29
1 7
1 18
1 8
1 42
1 48
1 16
1 56
1 52
1 7
1 16
1 2
1 2
1 19
1 5
1 51
1 29
1 11
1 21
1 20
1 18

1 52
1 58
1 38
1 67
1 31
1 5
1 7
1 5
1 6
1 14
1 4
1 81
1 32
1 15
1 13
1 3
1 67
1 43
1 28
1 34
1 23
1 26
1 29
1 2
1 74
1 32
1 29
1 14
1 30
1 31
1 91
1 7
1 5
1 17
1 12
1 54
1 12
1 14
1 9
1 9
1 40
1 11
1 12
1 12
1 7
1 6
1 44
1 18
1 1
1 100



Question 5

A researcher is studying traffic flow along a straight N -mile highway, where traffic moves in a single direction from mile 1 to mile N . To measure the flow of vehicles, they install N sensors—one per mile. However, due to a malfunction, each sensor only provides a range of possible values instead of an exact reading. For example, a sensor might report a traffic flow between 7 and 13 vehicles per unit time.

Some segments of the highway have on-ramps where additional vehicles enter, while others have off-ramps where vehicles exit. If a segment has an on-ramp, the sensor measures the number of vehicles entering. If a segment has an off-ramp, the sensor measures the number of vehicles exiting. If there are no ramps, the sensor directly measures the traffic flow along the highway. Each segment contains at most one ramp.

Given the readings from the N sensors, determine the most precise possible ranges for the initial traffic flow entering the highway before mile 1 and for the remaining traffic continuing past mile N . These ranges should be consistent with all sensor readings.

INPUT FORMAT:

The first line of input contains N ($1 \leq N \leq 100$). Each of the remaining N lines describes a 1-mile segment of the road, in order from mile 1 to mile N . Each line contains a string that is either "on" (if there is an on-ramp on this segment), "off" (if there is an off-ramp), or "none" (if there is no ramp), followed by two integers in the range $0 \dots 1000$, indicating the lower and upper endpoints of the sensor range from this segment. If the segment contains a ramp, the sensor reading is from the ramp. Otherwise, it is from the main highway. At least one of the highway segments will be designated as "none".

OUTPUT FORMAT:

The first line of output should contain two integers giving the most specific range possible for the rate of traffic flow prior to mile 1. The second line of output should contain two integers giving the most specific range possible for the rate of traffic flow after mile N . A valid solution is always guaranteed to exist.

SAMPLE INPUT:

```
4
on 1 1
none 10 14
none 11 15
off 2 3
```

SAMPLE OUTPUT:

```
10 13
8 12
```

Input

Case 1:

81

on 1 2

on 0 2

none 484 535

none 474 534

off 2 2

off 2 2

off 1 2

off 0 0

off 0 0

none 464 541

on 0 2

none 473 540

on 0 1

none 463 539

none 473 548

off 1 1

on 1 3

off 2 4

off 0 0

on 1 1

off 0 2

off 0 2

on 2 2

on 0 1

on 0 0

none 476 548

off 1 3

off 0 1

on 1 3

off 0 2

on 1 2

off 1 2

on 0 0

on 1 2

none 464 544

off 0 2

none 467 557

on 0 0

off 1 3

on 0 2

none 464 542

off 0 0

off 1 1

on 0 0

on 1 3

on 0 1

none 460 554
off 0 1
none 465 560
on 2 4
on 2 3
none 462 564
none 452 563
off 1 1
on 2 4
on 1 1
off 1 2
off 2 4
on 2 4
none 452 556
none 466 565
off 0 0
off 0 0
none 465 565
on 2 4
on 0 2
on 1 3
on 1 2
off 2 4
on 2 4
off 0 0
none 466 582
off 1 3
off 1 3
none 464 570
on 2 2
on 2 2
off 0 1
on 2 4
off 2 2
none 450 587

Case 2:

100
off 2 4
on 2 3
off 1 1
off 1 1
off 2 3
on 2 2
none 468 524
off 2 3
on 1 1
off 0 2
none 467 537
on 2 4

none 461 537
on 1 3
off 1 1
off 1 2
off 1 1
off 0 0
off 2 4
none 458 536
none 453 528
off 1 2
on 1 1
on 1 2
off 1 2
none 443 527
off 0 0
none 451 529
off 0 1
off 0 2
none 443 527
on 0 0
off 0 2
off 0 2
off 0 2
off 2 4
none 438 524
off 2 3
off 0 2
off 2 2
off 0 1
on 2 3
off 1 3
none 434 529
none 420 533
off 2 4
off 1 3
on 1 1
on 2 4
none 418 533
off 1 1
on 1 3
off 0 2
on 2 4
off 0 1
off 2 4
on 0 1
none 426 544
on 0 0
on 2 4
on 0 2
off 2 4

none 419 539
off 2 4
off 2 4
none 409 539
none 417 532
none 411 538
on 0 0
on 2 2
on 0 1
on 1 3
off 2 2
on 2 3
off 0 2
none 415 545
on 0 2
none 409 537
on 0 1
none 416 549
none 402 543
off 0 1
on 1 3
on 1 1
on 2 2
on 1 1
none 406 560
off 2 2
off 0 0
on 0 2
off 0 2
on 1 3
off 2 4
on 0 1
off 2 3
none 409 549
off 0 0
off 2 3
off 1 2
none 396 548

Question 6

A courier needs to deliver a package along a straight road, represented as a number line. The package must be transported from position a to position b , and the goal is to minimize the total distance traveled by vehicle.

To assist with transportation, there is a teleporter installed between two fixed locations, x and y . If the package reaches x , it can be instantly teleported to y , and vice versa. However, the courier still needs to travel by vehicle to and from any locations that are not connected by teleportation.

Determine the shortest total distance the courier must travel by vehicle to move the package from a to b .

INPUT FORMAT:

The first and only line of input contains four space-separated integers: a and b , describing the start and end locations, followed by x and y , describing the teleporter. All positions are integers in the range $0 \dots 100$, and they are not necessarily distinct from each-other.

OUTPUT FORMAT:

A single integer, representing the minimum distance the courier must travel by vehicle to move the package from a to b .

SAMPLE INPUT:

3 10 8 2

SAMPLE OUTPUT:

3

In this example, the best strategy is to move the package from position 3 to position 2, teleport it to position 8, then move it to position 10. The total distance requiring the vehicle is therefore $1 + 2 = 3$.

Input
Case 1: 35 68 2 30
Case 2: 58 23 67 70

Question 7

A coding competition platform is hosting an online contest where participants answer challenging problems to demonstrate their skills.

To accommodate a wide range of participants, the competition has four difficulty divisions: bronze, silver, gold, and platinum. All new participants start in the bronze division, and whenever a participant achieves a perfect score in a contest, they are promoted to the next division. It is even possible for a participant to be promoted multiple times within the same contest.

The platform maintains a list of all participants and their current divisions, ensuring they start at the correct level in future contests.

After the latest contest, the organizers want to publish statistics on how many participants were promoted from bronze to silver, silver to gold, and gold to platinum. However, they forgot to track promotions in real time. Fortunately, they realize that they can deduce the number of promotions based on the number of participants in each division before and after the contest.

Your task is to calculate the number of promotions that occurred at each level.

INPUT FORMAT:

Input consists of four lines, each containing two integers in the range 0..1,000,000. The first line specifies the number of bronze participants registered before and after the contest. The second line specifies the number of silver participants before and after the contest. The third line specifies the number of gold participants before and after the contest. The last line specifies the number of platinum participants before and after the contest.

OUTPUT FORMAT:

Please output three lines, each containing a single integer. The first line should contain the number of participants who were promoted from bronze to silver. The second line should contain the number of participants who were promoted from silver to gold. The last line should contain the number of participants who were promoted from gold to platinum.

SAMPLE INPUT:

```
1 2
1 1
1 1
1 2
```

SAMPLE OUTPUT:

```
1
1
1
```

In this example, 1 participant was registered in each division prior to the contest. At the end of the contest, 2 participants were registered in bronze and platinum. One way this could have happened is that 2 new participants joined during the contest; one was promoted all the way to platinum, and the other stayed in bronze.

Input
Case 1: 61313 95144 25857 1516 16124 45241 53895 75624 Case 2: 49676 130031 93368 5835 47739 52611 10012 105072

Question 8

You are given seven (not necessarily distinct) integers in the range $1 \dots 10^9$, which represent the values of A , B , C , $A+B$, $B+C$, $C+A$, and $A+B+C$ in some order. It is guaranteed that A , B , and C are positive integers and that $A \leq B \leq C$.

Determine and output the values of A , B , and C in ascending order.

INPUT FORMAT:

The only line of input consists of seven space-separated integers.

OUTPUT FORMAT:

Print A , B , and C separated by spaces.

SAMPLE INPUT:

2 2 11 4 9 7 9

SAMPLE OUTPUT:

2 2 7

Input
Case 1: 75355967 870798864 541745076 946154831 466389109 404409755 479765722
Case 2: 326552445 762589144 699462434 63126710 436036699 372909989 389679155