JOI 2012-2013 Qualification contest

Authors: JCIOI (Japanese Committee for the IOI)

Translators: Jasmine Chua, France-ioi

License: Creative Commons Attributions-ShareAlike 4.0 International License (CC BY-SA 4.0)

**Homework**

**QUESTION**

JOI has always had trouble completing his winter vacation homework, so he came up with a plan this year. He has practice drills to complete for Japanese and Math classes. There are A pages of Japanese practice drills, and B pages of Math practice drills.

In 1 day, JOI can complete a maximum of C pages of Japanese practice drills and D pages of Math practice drills. However, he will have no time to play on that day.

There are L days of winter vacation, and JOI must finish his homework by the end of the vacation. Create a program to find out the maximum number of days JOI gets to play during his winter vacation.

**INPUT**

The input has 5 rows, with 1 integer written in each row.

In the first row, L, where 2 ≦ L ≦ 40, is written. This represents the number of days of winter vacation.

In the second row, A, where 1 ≦ A ≦ 1000, is written. This represents the number of pages of Japanese practice drills.

In the third row, B, where 1 ≦ B ≦ 1000, is written. This represents the number of pages of Math practice drills.

In the fourth row, C, where 1 ≦ C ≦ 100, is written. This represents the maximum number of pages of Japanese practice drills JOI can complete in 1 day.

In the fifth row, D, where 1 ≦ D ≦ 100, is written. This represents the maximum number of pages of Math practice drills JOI can complete in 1 day.

Given the input data, ensure that JOI completes his homework within the winter vacation, and that he has at least 1 day of play.

**OUTPUT**

Output the maximum number of days JOI gets to play during his winter vacation in one row.

**INPUT/OUTPUT EXAMPLES**

**INPUT 1**

20

25

30

6

8

**OUTPUT 1**

15

**INPUT 2**

15

32

48

4

6

**OUTPUT 2**

7

In INPUT EXAMPLE 1, there are 20 days of winter vacation, 25 pages of Japanese practice drills, and 30 pages of Math practice drills. In 1 day, JOI can complete a maximum of 6 pages of Japanese practice drills and 8 pages of Math practice drills. If JOI starts doing 6 pages of Japanese practice drills and 8 pages of Math practice drills from Day 1, he will finish his Japanese homework by Day 5, and Math homework by Day 4, leaving him with 15 days of play. This is the maximum number of days JOI can play, so 15 is the output.

In INPUT EXAMPLE 2, if JOI starts doing 4 pages of Japanese practice drills and 6 pages of Math practice drills from Day 1, he will finish both subjects by Day 8. leaving him with 7 days of play. This is the maximum number of days JOI can play, so 7 is the output.

※Save each example's input/output data as a file by right-clicking the links.

**Unique number**

**QUESTION**

JOI and his friends are playing a game. There are N players in this game. The rules for each round of the game are as follows:

Each player writes a random integer from 1 to 100 on a card. If there are no other players who wrote down the same number, the player can get the number of points they had written down as a score. If there is at least 1 other player who wrote down the same number, both players get 0 points.

JOI and his friends played the game for 3 rounds. Given the numbers written by each player in each round, create a program to find out the total score of each player after 3 rounds.

**INPUT**

The input has (1 + N) rows.

In the first row, the number of players, N, where 2 ≦ N ≦ 200, is written.

For the next N rows, in the ith row, where 1 ≦ i ≦ N, 3 integers from 1 to 100 are written with a space between them. This represents the numbers written down by player i in the 3 rounds of the game.

**OUTPUT**

The output has N rows.

In the ith row, where 1 ≦ i ≦ N, output the total score of player i after 3 rounds of the game.

**INPUT/OUTPUT EXAMPLES**

**INPUT 1**

5

100 99 98

100 97 92

63 89 63

99 99 99

89 97 98

**OUTPUT 1**

0

92

215

198

89

**INPUT 2**

3

89 92 77

89 92 63

89 63 77

**OUTPUT 2**

0

63

63

In INPUT EXAMPLE 1, each player's total score is as follows:

Player 1: 0 + 0 + 0 = 0

Player 2: 0 + 0 + 92 = 92

Player 3: 63 + 89 + 63 = 215

Player 4: 99 + 0 + 99 = 198

Player 5: 89 + 0 + 0 = 89

※Save each example's input/output data as a file by right-clicking the links.

**Signboard**

**QUESTION**

JOI is making a new signboard for his store.

He already has N old signboards with evenly-spaced letters written on each. JOI will make the new signboard by erasing letters from an old signboard. After he is done, the remaining letters must spell out his store's name, and the letters must be evenly-spaced. He must make the new signboard from a single old signboard. He cannot cut or paste together any of the old signboards to create a new one.

Given the store's name and information about the N old signboards, create a program to find out the number of old signboards JOI can use to make his new signboard. Even if there are multiple ways to remake 1 old signboard, it will only be counted once.

**INPUT**

The input has (2 + N) rows.

In the first row, the number of old signboards, N, where 1 ≦ N ≦ 100, is written.

In the second row, a string of alphabets, ranging from 3 to 25, is written. This represents the store's name.

For the next N rows, in the ith row, where 1 ≦ i ≦ N, a string of alphabets ranging from 1 to 100, is written. This represents the letters written on old signboard i.

**OUTPUT**

Output one row, with the number of old signboards JOI can use to make his new signboard.

**INPUT/OUTPUT EXAMPLES**

**INPUT**

4

bar

abracadabra

bear

bar

baraxbara

**OUTPUT**

3

The store name is 'bar'.

The first signboard has 'abracadabra' written on it. If he keeps the 2nd, 6th, and 10th letters and erases the rest, he can make his new signboard.

For the second signboard, he can erase the 2nd letter to spell 'bar'. However, the letters will not be evenly-spaced.

The third signboard already has the correct name written on it.

For the fourth signboard, there are 2 ways to make the new signboard. First, JOI can keep the 1st, 2nd, and 3rd letters and erase the rest. Alternatively, he can keep the 6th, 7th, and 8th letters and erase the rest.

JOI can make his new signboard using either signboard 1, 3, or 4, so the output is 3.

※Save each example's input/output data as a file by right-clicking the links.

**Hot days**

**QUESTION**

While Japan is experiencing winter, it is summertime in Australia in the southern hemisphere. IOI lives in Australia, and is planning what clothes to wear, following the weather forecast for D days. On Day i, where 1 ≦ i ≦ D, the maximum temperature is predicted to be Ti degrees.

IOI has N different shirts, labeled from 1 to N. Shirt J, where 1 ≦ j ≦ N, is suitable on days where the maximum temperature is between Aj and Bj. In addition, each shirt has a 'fashion rating' depicted by an integer. Shirt j has a fashion rating of Cj.

For each day out of D days, IOI picks out 1 suitable shirt that is suitable for the maximum temperature predicted for that day. He can choose the same shirt more than once, or not at all.

IOI wants to avoid wearing similar shirts on consecutive days, so he wants the shirts on consecutive days to have as large a difference in fashion rating as possible. In other words, if he chooses shirt xi on day i, the total value |Cx1 - Cx2| + |Cx2 - Cx3| + … + |CxD-1 - CxD| must be maximum. Create a program to find out the maximum value possible for this.

**INPUT**

The input has (1 + D + N) rows.

In the first row, two integers are written with a space between them.

D, where 2 ≦ D ≦ 200. This represents the number of days to choose tops for.

N, where 1 ≦ N ≦ 200. This represents the number of shirts IOI has.

For the next D rows, in the ith row, where 1 ≦ i ≦ D, one integer is written.

Ti, where 0 ≦ Ti ≦ 60. This represents the maximum temperature predicted on day i.

For the next N rows, in the jth row, where 1 ≦ j ≦ N, three integers are written with a space between them.

Aj and Bj, where 0 ≦ Aj ≦ Bj ≦ 60. These represent that shirt J is suitable on days where the maximum temperature is between Aj and Bj.

Cj, where 0 ≦ Cj ≦ 100. This represents the fashion rating of shirt j.

Ensure that for each day out of D days, there is at least 1 shirt that is suitable for the maximum temperature predicted for that day.

**OUTPUT**

Output the maximum value possible for the difference in fashion ratings on consecutive days. In other words, output the maximum value for |Cx1 - Cx2| + |Cx2 - Cx3| + … + |CxD-1 - CxD| in one row.

**INPUT/OUTPUT EXAMPLES**

**INPUT 1**

3 4

31

27

35

20 25 30

23 29 90

21 35 60

28 33 40

**OUTPUT 1**

80

**INPUT 2**

5 2

26

28

32

29

34

30 35 0

25 30 100

**OUTPUT 2**

300

In INPUT EXAMPLE 1, IOI can choose between shirts 3 and 4 on Day 1, shirts 2 and 3 on Day 2, and only shirt 3 on Day 3. He will choose shirt 4 on Day 1, shirt 2 on Day 2, and shirt 3 on Day 3. In other words, x1 = 4, x2 = 2, and x3 = 3. Thus, the difference in fashion ratings is |40 - 90| = 50 between Days 1 and 2, and |90 - 60| = 30 between Days 2 and 3. The total is 80, which is the maximum value possible.

In INPUT EXAMPLE 2, he will choose shirt 2 on Day 1, shirt 2 on Day 2, and shirt 1 on Day 3, shirt 2 on Day 4, and shirt 1 on Day 5. Thus, the value is |100 - 100| + |100 - 0| + |0 - 100| + |100 - 0| = 300.

※Save each example's input/output data as a file by right-clicking the links.

**Fish**

**QUESTION**

The vast Indian Ocean lies to the west of Australia. JOI, a marine research scientist, is studying the nature of N species of fish living in the Indian Ocean.

Each fish species has a range of habitat shaped like a cuboid. A fish can move freely within any part of their range of habitat, but it cannot swim out of this range. There are sets of coordinates (x, y, d), depicting points in the sea. x is the position from the East when viewed from the top, y is the position from the North, and d is depth from the water surface. Assume that the ocean's surface is flat.

JOI wants to know the volume of the ocean where the range of habitats for at least K species of fish overlap. Create a program to find out the total volume of this.

**INPUT**

The input has (1 + N) rows.

In the first row, two integers are written with a space between them.

N and K, where 1 ≦ K ≦ N ≦ 50. These represent that there are N species of fish, and JOI wants to know the volume of ocean where the range of habitats for at least K species of fish overlap.

For the next N rows, in the ith row, where 1 ≦ i ≦ N, six integers are written with a space between them.

Xi,1, Yi,1, Di,1, Xi,2, Yi,2, and Di,2, where 0 ≦ X/Y/Di,1 ＜ X/Y/Di,2 ≦ 1000000 (= 106). This represents that fish species i has a range of habitat within these 8 coordinates: (Xi,1, Yi,1, Di,1), (Xi,2, Yi,1, Di,1), (Xi,2, Yi,2, Di,1), (Xi,1, Yi,2, Di,1), (Xi,1, Yi,1, Di,2), (Xi,2, Yi,1, Di,2), (Xi,2, Yi,2, Di,2), (Xi,1, Yi,2, Di,2).

**OUTPUT**

Output the total volume of the ocean where the range of habitats for at least K species of fish overlap in one row.

**INPUT/OUTPUT EXAMPLES**

**INPUT 1**

3 2

30 50 0 50 70 100

10 20 20 70 90 60

40 60 20 90 90 70

**OUTPUT 1**

49000

**INPUT 2**

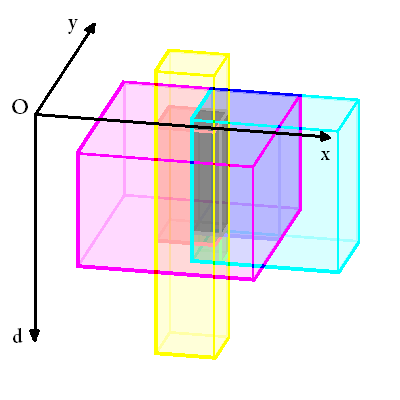
1 1

0 0 0 1000000 1000000 1000000

**OUTPUT 2**

1000000000000000000

In INPUT EXAMPLE 1, coordinate (45, 65, 65) is part of the range of habitat for fish species 1 and 3, and thus fulfils the condition. On the other hand, coordinate (25, 35, 45) is part of the range of habitat for fish species 2 only, so it does not fulfil the condition. The range of habitat for each species is shown below. Coordinate O represents the origin on the ocean's surface.



※Save each example's input/output data as a file by right-clicking the links.

**Gifts**

**QUESTION**

JOI is in Australia for a vacation. He visited several sightseeing spots, and today is the last day of his vacation. Now, JOI is in the city where the international airport is located. This city is divided into a grid, and each square of the grid contains either a road, souvenir store, residential housing, or the airport. JOI starts off in the most northwestern square, and will move to the airport, which is in the most southeastern square.

JOI can move to any square that is adjacent to the square he is currently on, unless that square contains residential housing. To reach the airport on time, he should only move towards the South or East. However, he still has some time, so he can travel North or West up to a total of K times.

When JOI moves to a square with a souvenir store, he will buy some gifts for his friends back home. Having done some research, he knows how many gifts he needs to buy in each store. Create a program to find out the maximum number of gifts JOI buys.

Assume that the time JOI spends buying gifts is negligible. If he visits the same souvenir store more than once, he will only buy gifts during his first visit.

**INPUT**

The input has (1 + H) rows.

In the first row, three integers are written with a space between them.

H, where 2 ≦ H ≦ 50.

W, where 2 ≦ W ≦ 50.

K, where 1 ≦ K ≦ 3.

For the next H rows, strings of W characters are written with a space between them. These represent the information about the city. The square that is ith from the North, where 1 ≦ i ≦ H, and jth from the West, where 1 ≦ j ≦ W, is (i, j). The following characters are used:

'i' represents a road or airport.

'#' represents residential housing.

'1', '2', ..., '9' represents souvenir stores. The integer represents the number of gifts JOI will buy there.

In the given input data, ensure that JOI starts off from the most northwestern square, and that there is a route for him to reach the airport.

**OUTPUT**

Output the maximum number of gifts JOI buys in one row.

**INPUT/OUTPUT EXAMPLES**

**INPUT 1**

5 4 2

...#

.#.#

.#73

8##.

....

**OUTPUT 1**

11

**INPUT 2**

4 4 3

.8#9

9.#.

.#9.

....

**OUTPUT 2**

27

In INPUT EXAMPLE 1, JOI will move South 3 times to square (4, 1). He will buy gifts there, then move South once, East 3 times, then North twice to reach square (3, 4). He will buy gifts there, then move South twice to reach the airport. He will buy 11 gifts in total.

※Save each example's input/output data as a file by right-clicking the links.