TeamsCode Fall 2019 Silicon Valley Programming Contest Problem Set

Rules:

1. You have 3 hours to solve 15 problems. Each problem has 3 test cases and each correct test case is worth 10, 20, or 30 points, depending on whether the problem is easy, medium, or hard, respectively.
2. Email your solution code to teamscodejudging@gmail.com. You get 2 submission attempts for each problem. In the subject line, please specify your team name, the problem number, and the language you used (e.g. Epic Coders Easy #1 Java). In the message body, paste your code in its entirety.
3. Hardcoded solutions and solutions that take longer than 5 seconds to run will automatically be marked as incorrect.
4. You will only be competing with others in your division. Ties will be broken by the time that the last correct test case was received.

Table of Contents

Contest Shortcut [Easy #1]

Jeff lives far away from Union Church and he’s going to be late to the TeamsCode contest! He knows that Union Church is x kilometers east and y kilometers north away from his house. Jeff wants to know the distance he will save if he walks to the contest in a straight line as opposed to walking only east and north. You can assume that he has magical powers that allow him to walk through any object in his way.

Input:

The input will consist of an integer x, the distance east from house to the church, and an integer y, the distance north from house to the church.

Output:

Output the distance in kilometers that Jeff will **save** by walking in a straight line instead of only east and north. The distance will always be a whole number.

Sample Input:

```
5 12
```

Sample Output:

```
4
```

Competition Rankings [Easy #2]

The science competition results have been posted but they're out of order! Ari urgently wants to know what his rank is. Given Ari's score as well as everyone else's score, determine what rank Ari has earned. Assume that no two scores are identical.

Input:

The first line contains an integer N from 0 to 100 that represents Ari's score.
The second line contains an integer R, which represents the number of students in the class.
The third line contains R integers, one of which will be equivalent to Ari's score.
Assume that nobody else got the same score as Ari.

Output:

Output Ari's ranking assuming that the highest rank is 1, and the lowest rank is R.

Sample Input:

```
85
10
94 69 86 99 74 73 85 82 77 65
```

Sample Output:

```
4
```

DNA Sequencing [Easy #3]

After a thermonuclear detonation, exposure has resulted in everyone’s DNA being mutated. A mutation is defined by a gene location in which a base pair is paired with the incorrect corresponding pair. For instance, if Adenine [A] is paired with Guanine [G] rather than Thymine [T], then that is considered a mutation. Given the initial strand and the complementary strand of a person’s DNA, find the number of mutations that exist in their sequence.

Adenine [A] pairs up with Thymine [T].
Guanine [G] pairs up with Cytosine [C].

Input:

The first line contains the initial strand of DNA. Each base pair is abbreviated with its first letter.
The second line contains the complementary strand of DNA.

Output:

Print the number of mutations.

Sample Input: (mutations have been bolded for convenience)

AC**C**TGAG**C**TA
TG**T**ACTC**C**AT

Sample Output:

```
2
```

Board Game [Easy #4]

You are playing a certain board game where the location on the board that you move to depends on your current location. For instance, if you are on the 1st space and that space contains a 5, then you would move to the fifth space. This continues on until you hit the space containing zero, which ends the game. In this problem, you start on the first space.

Input:

The first line contains an integer N, the number of spaces.
The second line contains N numbers, which defines the board. The finish is represented by a `0`.

Output:

Print the number of moves that it takes to reach the finish. Don't count the move to get onto the initial space. If it's not possible to reach the finish, then print `-1`.

Sample Input:

```
10
2 7 5 8 0 6 3 4 2 9
```

Sample Output:

```
4
```

Cheater Beater [Easy #5]

While taking a math test, you notice the people near you keep glancing at your paper. In order to prevent them from cheating, you place a cover sheet over certain parts of your test. Calculate the area of your test that is being covered by the cover sheet given the coordinates of both papers.

Input:

The first line contains 4 integers x_1, y_1, x_2, and y_2, where (x_1, y_1) and (x_2, y_2) are the bottom left and top right coordinates of the cover sheet respectively.
The next line contains 4 more integers that define the bottom left and top right coordinates of the test sheet. All coordinates will be positive integers.

Output:

Output the area of the test that is covered by the cover sheet.

Sample Input:

```
5 3 10 9
8 4 14 10
```

Sample Output:

```
10
```

Chess Mania [Medium #1]

You are playing chess with a friend and accidentally forgot the rules and cleared the board of all the pieces except for the queen. The chess board is also quite unique, with N rows and N columns. Determine how many squares the queen can move to given its starting position, not including the starting position.

The queen can move along the diagonals and vertical or horizontal lines for any amount of distance.

Input:

The first line contains a number N, the number of rows and columns in the board. The next line contains two numbers. The first number is the row number of the queen and the second number is the column number of the queen. $(1, 1)$ would represent the bottom left square and (N, N) would represent the top right square.

Output:

Output the number of squares that the queen can move to (excluding the square it is currently on).

Sample Input:

```
8
3 4
```

Sample Output:

```
25
```

Area 52 [Medium #2]

IBF agents are afraid of a possible incoming Area 52 raid. They want to build a massive fence around the perimeter of the military base. Help them figure out how much fence they will need in order to stop those pesky raiders!

Input:

The first line contains an integer N.
The next N lines contain N characters that represents an N by N grid. An asterisk [*] represents a square foot of the Area 52 base and a period [.] represents a square foot of empty space. There will only be one military base present and you can assume that the area outside of the N by N grid is empty.

Output:

Output the perimeter of the base (the shape created from the asterisks [*]) in terms of feet.

Sample Input:

```
6
.**...
.****.
****..
*****.
.***..
...*..
```

Sample Output:

```
24
```

Returning to Earth [Medium #3]

Bob is stranded in space on limited food supply and is thus looking for the quickest way to return to Earth. He is currently a distance of x_0 away from Earth. Fortunately, Bob has a teleportation machine. If his distance from Earth is a multiple of 4, he can divide his distance from Earth by 4 in one move. Also, if his distance is a multiple of 3, he can divide his distance by 3 in one move. Lastly, he can subtract 1 from his distance in one move as well. Find how many moves it will take for him to reach Earth, where his distance x_0 is equal to 0.

Input:

The first and only line contains a single integer x_0, which is Bob's distance from Earth.

Output:

Output the minimum number of moves Bob needs to return to Earth.

Sample Input:

```
124
```

Sample Output:

```
7
```

Mars Colony [Medium #4]

SpaceZ is looking for a suitable place to begin building a colony on Mars. However, there are only specific areas that can be built because of toxic wastelands. Find the largest area that SpaceZ's colony can be assuming once they land they cannot cross the toxic wastelands. The colony can be any shape given that they are contiguous.

Input:

The first line contains integer $N.$
The next N lines contain N characters each to form a NxN grid. A hashtag [#] represents areas that can be built on and a period [.] represents toxic wastelands that cannot be built on.

Output:

Output the area of the largest possible colony [#] that can be built without crossing over toxic wastelands [.]

Sample Input:

```
7
##....#
#..##..
#.#####
...####
..###..
....##.
##.....
```

Sample Output:

```
16
```

Civil Cipher [Medium #5]

It is 1864, and you are a technician for the Northern American Army. The Confederate Army (your enemy) sends a message to their front lines, and you happen to intercept it. You know exactly how they encrypt their message:

Each letter depends on the **final** value of the letter to its right, except for the last letter, which always remains the same. The letter to the left of the last letter will be frame shifted upwards by the value of the letter (with a being 1 and z being 26). In other words, if we were to encrypt the string “sad”, the ‘d’ remains the same, but the ‘a’ becomes ‘e’ since ‘a’ equals 1 and ‘d’ = 4, and 1 + 4 = 5, which is ‘e’. Then, the first letter in the output depends on the second letter in the output and the first letter in the input and becomes ‘s’ + ‘e’ = ‘x’, so the final string is “xed”. Please note that letters that are uppercase will remain uppercase. Hint, the ASCII value of ‘A’ is 65 and the ASCII value of ‘a’ is 97.

Knowing this encryption method and the encrypted word, find the initial word that the Confederate Army sent. In other words, find the inverse of the above algorithm.

Input:

The first line will contain the string to be deciphered, or the encrypted word.

Output:

Output the decrypted version of the string based on the known cipher.

Sample Input:

```
Witbh
```

Sample Output:

```
North
```

The last letter is always the same. Then, the ‘b’ in “Witbh” comes from the ‘h’ in “Witbh” and the ‘t’ in “North”.

Yourcraft [Hard #1]

Night is approaching and Steve desperately needs to get back to sleep in his bed. Unfortunately, on his journey, he blocked off part of the path with various blocks. Each block takes a certain amount of time to break, and he must break the block if he wants to travel through that tile. Find the shortest amount of time it would take for Steve to get home if he follows the ideal path. Steve can only move horizontally or vertically, not diagonally.

Input:

The first line contains the integer N.
The next N lines contain N numbers each. Each integer represents the time it takes to break that block. Steve is represented by an `S`. His house is represented by an `H`.

Output:

Output the shortest amount of time it takes for Steve to get home.

Sample Input: (Steve's path is bolded for convenience)

5
1 3 2 7 3
S 7 **6 4 5**
7 5 2 9 **1**
4 1 9 4 **H**
3 6 2 7 5

Sample Output:

```
22
```

Froggers [Hard #2]

Commit the Frog needs to travel to the pond. He can get back by following a straight line; however, there are many rocks in his path that he can't land on. Commit can jump a maximum of M spaces every time his jumps. How many unique ways are there for Commit to get to the pond? For example, if M is 3 then Commit can jump 1, 2, or 3 spaces.

Input:

The first line contains the integer N, followed by the integer M.

The next line contains N numbers, which are all either `0` or `1`. Empty spaces are represented by `0`'s and Rocks are represented by `1`'s. He begins on the very first empty space in the sequence of numbers. (Note: there will always be an empty space at the beginning and end of the list.)

Output:

Output the total possible number of different movesets Commit can take to get to the end of the path.

Sample Input:

```
12 3
001000010010
```

Sample Output:

```
40
```

Mixed Feelings [Hard #3]

Sam and Harry have opposing viewpoints on whether to go to the history classroom or the library during their free period. While Sam wants to go to the library, Harry wants to go to the history room.

On the very first day, there is of Sam going to the library and a $2/5$ chance of Sam going to the history room. On the other hand, there is a chance of Harry going to the history room and a $2/5$ chance of Harry going to the library. If Sam goes to the history room on any day, the probability of him going there again becomes $1/3$ of what it initially was. For instance, after the first time Sam goes to the history room, the probability of him going there in the future becomes $2/15$. Likewise, whenever Harry goes to the library on any given day, the probability of him going there again in the future becomes $1/3$ of what it initially was.

Given Sam and Harry's schedules for the first N days, find the probability that, on the kth day, Sam goes to the library and Harry goes to the history room. Give your answer as a reduced fraction. k can be any integer greater than zero within a reasonable range. (Hint: Use longs).

Input:

On a single line, there are three space-separated values. The first is a string representing Sam's schedule, and the second is a string representing Harry's schedule. The third is the value k.

Output:

On a single line, print the probability Sam goes to the library and Harry goes to the history room in a single reduced fraction.

Sample Input:

```
HHL LLH 4
```

Sample Output:

```
1849/2025
```

Last Knight [Hard #4]

Brandon is playing a strange variation of chess with himself. He controls a Knight (knights can move 2 spaces in one direction and 1 space in another direction perpendicular to the original move - imagine an L shape) and he also controls the enemy King (kings can move one space in any direction, including diagonally). His goal is to have the knight capture (land on the same tile as the King) assuming the path he takes is the shortest possible path. On the first move, the player must start with the knight move. Furthermore, the King **cannot** run into the knight; the knight must jump onto the King. He must also move **both the King and the Knight every turn.**

Input:

The first line contains integer N.
The next N lines contain N characters each to form a NxN grid. The knight is represented by an H , the king is represented by K , blockades are represented by [#], and empty spaces are represented by [*].

Output:

Output the minimum number of moves it would take the knight to reach the king.

Sample Input:

```
8
#*##**#*
N**####*#
*##*****
#***#*#*
#*##****#
**#*#*#*
##**K***
*##*****
```

Sample Output:

```
3
```

Intense Poker [Hard #5]

Sean and Winbert are playing Texas Hold'Em style poker. In this version of poker, each player has 2 cards in their hands, consisting of either the number values 2 - 10 or the 4 face cards, A, K, Q, or J. There are also 5 cards in the middle of the table. Each person's complete hand consists of the best hand they can make out of the two cards in their hand and the five cards in the middle. The person with the best hand wins. Whenever both players have equally good hands, usually the person with the highest card wins. However, if their highest cards are the same, then print "`tie`". These are the following hand rankings, starting with the highest:

Royal Flush – A K Q J 10, same suit
Straight Flush – 5 cards in ascending order, same suit (A 2 3 4 5 counts). Tie goes to the highest card in the straight.
Four of a Kind – four cards with the same number or letter. Tie goes to the highest card.
Full House – 3 of the same number/letter + another 2 of the same number/letter. Tie goes to the highest 3-of-a-kind card.
Flush – 5 of the same suit. Tie goes to the highest card.
Straight – 5 cards in ascending order. Tie goes to the highest card in the straight.
Set – 3 cards with the same number/letter. Tie goes to the highest card.
Two Pairs – 2 pairs of cards with the same number/letter. Tie goes to the highest pair.
Pair – one pair of the same number/letter. Tie goes to highest pair.
High Card – If neither player has any of the above, the person with the highest card wins.

If one of these is achieved within the middle 5 cards (suppose they were A A A A K), the person with the highest card wins. All the no-suites are treated equally.

Input:

The first line will consist of a 5 space separated letters, representing the suits of the cards. Clubs are denoted by C, Diamonds by D, Hearts by H, and Spades by S. Next, it will contain 5 space-separated card values, representing the cards in the middle. The next line will have the suite of Sean's first card, the value of the first card, the suite of the second card, and then the value of the second card. The last line represents the same thing for Winbert.

Output:

Print out the winning hand. In the case of both players having the exact same hand and card (ex: exact same pair), then take the next highest card. If those two cards are the same, then print the next highest. If two people have identical hands (if they both have a 10 and 9), then and only then print “tie”. **Print the hand in the order cards were shown (community cards first). If there are less than 5 cards in determining the winner, only print the important cards (Ex: in a high card scenario, print the single high card that allows the player to win)**

Sample Input:

```
C D S C H K 9 10 8 6
H 5 S K
H 7 D J
```

Sample Output:

```
D9 S10 C8 H7 DJ
```