

SI 100B Programming Assignment 2

SI 100B Staff

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Important message on plagiarism

The single most important point for you to realize before the beginning of your studies at ShanghaiTech is the meaning of “plagiarism”:

Plagiarism is the practice of taking someone else's work or ideas and passing them off as one's own. It is the misrepresentation of the work of another as your own. It is academic theft; a serious infraction of a University honor code, and the latter is your responsibility to uphold. Instances of plagiarism or any other cheating will be reported to the university leadership, and will have serious consequences. Avoiding any form of plagiarism is in your own interest. If you plagiarize and it is unveiled at a later stage only, it will not only reflect badly on the university, but also on your image/career opportunities.

Plagiarism is academic misconduct, and we take it very serious at ShanghaiTech. In the past we have had lots of problems related to plagiarism especially with newly arriving students, so it is important to get this right upfront:

You may...

- ... discuss with your peers about course material.
- ... discuss generally about the programming language, some features, or abstract lines of code. As long as it is not directly related to any homework, but formulated in a general, abstract way, such discussion is acceptable.
- ... share test cases with each other.
- ... help each other with setting up the development environment etc.

You may not ...

- ... read, possess, copy or submit the solution code of anyone else (including people outside this course or university)!
- ... receive direct help from someone else (i.e. a direct communication of some lines of code, no matter if it is visual, verbal, or written)!
- ... give direct help to someone else. Helping one of your peers by letting him read your code or communicating even just part of the solution in written or in verbal form will have equal consequences.
- ... gain access to another one's account, no matter if with or without permission.
- ... give your account access to another student. It is your responsibility to keep your account safe, always log out, and choose a safe password. Do not just share access to your computer with other students without prior lock-out and disabling of automatic login functionality. Do not just leave your computer on without a lock even if it is just for the sake of a 5--minute break.
- ... work in teams. You may meet to discuss generally about the material, but any work on the homework is to be done individually and in privacy. Remember, you may not allow anyone to even just read your source code.

With the Internet, "paste", and "share" are easy operations. Don't think that it is easy to hide and that we will not find you, we have just as easy to use, fully automatic and intelligent tools that will identify any potential cases of plagiarism. And do not think that being the original author will make any difference. Sharing an original solution with others is just as unethical as using someone else's work.

0 Prelude: Twisted Fate’s Show - Lady Luck Is Smiling

Twisted Fate was a notorious card master and fraudster, a charmer and gambler across Runeterra.

He was one of the river nomads who roamed the Delta. As a child, Twisted Fate found his real destiny at the gambling table on a sailboat in the Bilgewater. When he first picked up the cards, he suddenly appreciated the game and skill of the luck. Years earlier, his superstitious grandfather had taught him how to read omens in the shuffle, while his aunt later taught him how to observe the information revealed by the opponents’ movements. With these two skills, Twisted Fate acted like a seasoned master in all risky games. No matter the circumstances, Twisted Fate will always have an ace up his sleeve.

One night, Twisted Fate shew up again at a resplendent and magnificent casino. A audience of his virtuosity, Kyran, recorded Twisted Fate’s fabulous gamble show and made it public in order to let all citizens of Runeterra to admire Twisted Fate’s greatness.

‘Cheater’ is a fancy name for winners. Twisted Fate said.

Spirits Menu: Something in Your Destiny:

- ♠ In this story, the order of playing cards is somewhat different from your previous knowledge. For the number of the poker card, we have $2 < 3 < 4 < 5 < 6 < 7 < 8 < 9 < T < J < Q < K < A$. For the suits, we have $D < C < H < S$, where D, C, H, S denote Diamond♦, Club♣, Heart♥, Spade♠, respectively. No Jokers will be contained in the following Acts.
- ♠ When comparing two poker cards, the number takes priority, and the suit takes second place. For example, $\clubsuit 6 > \heartsuit 5$, but $\clubsuit 6 < \spadesuit 6$.
- ♠ We use ‘symbol of suit’ + ‘symbol of number’ in a **string** to denote a certain corresponding card. For example, “ HA ” == $\heartsuit A$, which both mean the Ace of Heartsuit. “ $S7$ ” == $\spadesuit 7$, both meaning the seven of Spadesuit.
- ♠ All libraries are **FORBIDDEN** in this assignment. Those students who break this rule will get **ZERO** points for this PA.
- ♠ No excuses for the delay. **No** assignment will be accepted after the deadline, no matter what the reasons or excuses. Those students who break this rule will get **ZERO** points for this PA.

1 Act 1: STACKED DECK

Every eye in the Glory & Fortune Casino was on Twisted Fate. He smelled a mixture of jealousy and excitement in the eyes of many of the patrons in the casino, or a vicious desire to see him lose everything on his last card.

Except for the usual greediness of the casino, he sensed a distinct smell lurking in the crowd. The cards were stirring, warning him of the danger around him. A man with an eye patch in the

corner and a gorgeous brunette next to him seemed to be chatting with the bartender, but their eyes never left Twisted Fate. He was aware that these two men were the scoundrels of Bilgewater and the bounty hunters known throughout Runeterra. He knew he had to lay down his cards as soon as possible to find the passage back when he saw the man with the blindfold weighs. However, the temptation was too great to resist.

Sitting in front of him was a greedy merchant whose wealth was built on the whips of slave miners. He was dressed in an expensive robe: Freljord ermine, hand-sewn leather, Bilgewater design style. He wore blood-gold rings on each finger, each worth more money than most people had ever seen or even thought. The clay pipe he held in his mouth emitted exotic scented green smoke, piled in front of him all kinds of wealth, coins, jewelry, and all kinds of bills, looking like a pirate's treasure trove.

Twisted Fate nodded to the merchant with a faint smile. *"I think it's time to shuffle the deck, Mr.Mane."*

"Poor bastard, you do this sort of boring stuff." Mane said, a puff of smoke coming out of his nostrils.

1.1 Twisted Fate's Play

Twisted Fate's first play was to gather some poker cards from several players and shuffle them into a specific order. Specifically, the staff of Glory & Fortune Casino will give Twisted Fate a csv file that contain several rows of cards. Each row of cards denotes one player's cards. He would return a ordered card list without duplicated items.

Hint: We do not guarantee that each row has an equal number of columns or that the cells are not empty.

1.1.1 Input Format

A string that refers to the relative path of a **csv** file. When you test your code on your own computer, you can use the filename like "sample.csv". Note that you do not have to care about what is happening on OnlineJudge or what is "stacked.in". Do not modify the `main()` function!

1.1.2 Output Format

The only line of output contains a list contained an ordered cardset whose elements are all from the input file. Note that sorting is in descending order.

1.1.3 Sample

Input(In the csv file):

```
CA , SA , S2 , C2 , ST , H3
H5 , H6
SJ , DK , SQ
```

Output:

```
['SA', 'CA', 'DK', 'SQ', 'SJ', 'ST', 'H6', 'H5', 'H3', 'S2', 'C2']
```

Input(In the csv file):

```
HA , H2 , H3  
HA , H2 , H3  
HA , H2 , H3
```

Output:

```
[ ' HA ' , ' H3 ' , ' H2 ' ]
```

2 Act 2: PICK CARDS

“Don’t think you can even fool me with your little tricks. Mane took the shuffled cards and shuffled them again haphazardly.

“Fool you? Twisted Fate said in surprise, holding up his hands and exuding a simple, straightforward confidence. “For the record, I would never use such dishonorable and ugly tricks.”

“Would never? Then why are you glancing around? Mane said with a fierce look on her face. “Listen, I’ve dealt with all kinds of people, and I know best what people are like when they’re desperate. Now, game starts. The rules are simple, just as simple as Russian roulette.”

Twisted Fate gave a wry smile, played with his cards in his hand, then took off his wide-brimmed hat with an exaggerated gesture in silence. In the reflection in the goblet, a bunch of Bilgewater punks locked the back door of the casino.

2.1 Twisted Fate’s Play

Twisted Fate was going to play the first round of the ‘Bilgewater Wave Cards’ with Mane. The rules of the card game are as follows:

1. About the basic rules of the game: As the name of this game suggests, the dealer will keep putting out cards as an **attack**, just like the waves of Bilgewater. And the player must respond by choosing **smallest overcards** in the same format in his hand as **defence**.
2. About the determination of victory and defeat: There are n round of attacks, and Twisted Fate has m HPs. If Twisted Fate cannot respond with overcards, the Twisted Fate lost 1HP. If the Twisted Fate’s hand was fully played or the Twisted Fate’s HP was still greater than 0 after n attacks (whether or not there are still cards in the hand), Twisted Fate wins. If at any moment Twisted Fate’s HP drops to 0, then Mane won.
3. About the same format: The same format refers to the same amount of cards sharing the same number, **ignoring the suits of cards**. A single card has the same format with other single cards. A pair also has the same format with other pairs, etc..

For example: $\{S7, H7\}$ has the same format with $\{C6, H6\}$ since they are both pairs of poker card (ignoring the suits). The only difference of two pairs is just the numbers.

4. About the kinds of format: In this round, we only care about the four cases: Single, One-Pair, Three-of-a-Kind, and Four-of-a-Kind.

For example: Single: $\{C6\}$; One-Pair: $\{S8, C8\}$, Three-of-a-Kind: $\{SA, HA, CA\}$, Four-of-a-Kind: $\{S2, H2, C2, D2\}$

5. About the smallest overcards:

- (a) Firstly, about the “overcards”: overcards must have the same format as the smaller-cards. The overcards must be strictly greater than smaller-cards i.e., every elements in the overcards must be greater than the smaller-cards. Otherwise, they can not be the overcards.

For example, $\{S7, H7\}$ has the same format with $\{H6, C6\}$. And the former has the bigger number, so it could be the overcards. On the contrary, $\{SA, DA\}$ is not strictly greater than $\{HA, CA\}$ since $SA > HA, SA > CA$ but $DA < HA, DA < CA$.

Hint: The number of cards still hold priority when picking overcards

- (b) Secondly, about the “smallest”: The smallest overcards are the closest card-subset bigger than the smaller cards.

For example, if Mane played $\{H6, C6\}$ as an attack, and Twisted Fate had both $\{S7, H7\}$ and $\{S8, H8\}$, the smallest overcards is $\{S7, H7\}$ instead of $\{S8, H8\}$. Because 7 is closer to 6 than 8.

Hint: While picking a subset, you have to consider the order. For example, if you want to pick 2 Aces from 3 Aces $\{SA, HA, CA\}$, you have to choose $\{HA, CA\}$ since it is the smallest subset of $\{SA, HA, CA\}$

6. Note that the same card (same number and suit) does not appear twice.

Hint: It may be partly like the Chinese poker game: Peasants vs Landlord

2.1.1 Input Format

The input contains $n + 2$ lines.

The first line of input contains two integers n and m , separated by a single “,”.

The second line of input is a series of card which represents Twisted Fate’s cards (his own card set), separated by “,”.

The following n lines of input are Mane’s attack(the cards he played), separated by “,”.

2.1.2 Output Format

If Twisted Fate managed to defend, i.e., there was overcards in Twisted Fate’s hand, print the overcards he played in response as a list in the order of the rules described above. Otherwise, he will lose 1HP and print “Pass”.

Generally, the output may contain three kinds of cases.

Case1 : If Twisted Fate can persists until Mane finished all his attacks:

In this case, the output may contains $n + 1$ lines.

The first n line of output are the responses of Twisted Fate. The last line includes the result of the game and the HP left of Twisted Fate.

Format of last row: “Twisted Fate won with k HP left.”, where k is the number of HP Twisted Fate still had.

Case2 : If Twisted Fate lost all his HP in the game(including the last attack):

In this case, the number of lines in the output is not sure.

Format of last row: “Twisted Fate lost all his HP and lost.”

Case3 : If Twisted Fate played all the cards in his hand in the game:

In this case, the number of lines in the output is not sure, too. Twisted Fate might ran out of cards in his hand before Mane hit his full attack.

Format of last row: “Twisted Fate won with k HP left.”, where k is the number of HP Twisted Fate still had.

2.1.3 Sample

Input[1]:

```
5,3
SA,CA,DK,SJ,CJ,ST,HT,H5,H3,S3,C3
S2,H2
D2
D3
HA,DA
SQ,DQ
```

Output[1]:

```
['H3','C3']
['S3']
['H5']
Pass
['SA','CA']
Twisted Fate won with 2HP left.
```

Input[2]:

```
2,1
S3,C3
HA,DA
SA
```

Output[2]:

```
Pass
Twisted Fate lost all his HP and lost.
```

Input[3]:

```
2,1
S3,C3
H2,D2
SA
```

Output[3]:

```
['S3','C3']
Twisted Fate won with 1HP left.
```

3 Act 3: FULLHOUSES ALWAYS WIN

“The look on your face tells me you know you’ve lost.” Mane, with the pride and scorn of a bastard like him, took all the gold he had won from the middle of the table.

“Shall we try something more interesting, Sir?” Twisted Fate replied, laying the cards in an arc. *“How about doubling?”*

“Do you have that much money?” Mane asked incredulously.

“Easy.” Twisted Fate said, looking Mane straight in the eyes and taking out a heavy bag of coins from his large coat. *“Well?”*

Mane licked his lips and snapped his fingers. A servant handed over a bag of coins of the same size from behind him. The golden mountain in the center of the table was enlarged again. There is enough wealth here to start any war fought over money in history. The patrons of Glory & Fortune Casino sighed in unison. Amidst the hubbub of the crowd, a clown with a creepy smile disappeared in a corner, leaving only a box painted with stripes.

3.1 Twisted Fate’s Play

This act is the extension of the Act2. Now Twisted Fate and Mane decided to make a small change to the rules. They intended to add a new format of card, the Fullhouse, into format pool while **maintaining other rules of Act2**.

One Fullhouse is contained one three-of-a-kind and one pair. For example: $\{SQ, HQ, CQ, CK, DK\}$, $\{H8, C8, D8, S2, D2\}$. We can see, the former three cards share one same number while the latter two cards share another number.

When comparing fullhouses, both Pair and Three-of-a-kind of the larger fullhouse need to be strictly larger than Pair and Three-of-a-kind of the smaller fullhouse. Satisfying this requirement, we have the overcards of fullhouses.

There is an extra rule while choosing the smallest overcards for the family of fullhouses: the three-of-a-kind always holds the priority. For example, if Mane played $\{S4, H4, C4, C3, D3\}$ as an attack and Twisted Fate got $\{S5, H5, C5, D5, S6, H6, C6, D6\}$, he should played $\{H5, C5, D5, C6, D6\}$ instead of $\{H6, C6, D6, C5, D5\}$ as defence.

3.1.1 Input Format

The input format is basically as well as Act 2. However, the Fullhouses may be in the Twisted Fate’s hand or Mane’s attack.

3.1.2 Output Format

The main rules are the same as Act2.

However, one should note that the output of Fullhouses are in the form of *AAABB*, pairs are after three-of-a-kind, for example: {♠3, ♥3, ♣3, ♣6, ◇6}

3.1.3 Sample

Input[1]:

```
3,2
HK,CA,DK,SJ,CJ,ST,HT,H5,H4,S4,C4
S2,H2,D2,HA,DA
S3,H3,D3,H9,D9
SA
```

Output[1]:

```
Pass
['S4','H4','C4','ST','HT']
Pass
Twisted Fate lost all his HP and lost.
```

4 (Bonus)Act4: WILD CARD

Gamblers came and went, the bartender served Mane countless beers, Twisted Fate always set up a trap to make him lose badly every time he was about to win back his money or even make some small profit. After more rounds than Mane care to remember, he lost his patience and his eyes grew fierce. “You show your cards first,” said Mane, staring intently at the cards Twisted Fate was playing with in his hand. Twisted Fate was still smiling, pressing down on the brim of his hat. In the shadow of his brim, his eyes were fixed on every danger around him. ”As usual,” agreed Twisted Fate. Meanwhile, the bounty hunter made his move. The man with the eye patch in on him with a lasso. The woman called out Twisted Fate’s name while pulling out a pair of pistols. The creepy joker also flickered out of the mists into the crowd.

4.1 Twisted Fate’s Play

Before Twisted Fate escaped, he needed to determine if his cards contains a sure bet, in this case a Straight Flush. A straight is a deck of five cards with consecutive numbers, while Flush refers to five cards sharing the same suit. Therefore, a Straight Flush is a straight sharing the same suit. For example: *S3, S4, S5, S6, S7*(♠3, ♠4, ♠5, ♠6, ♠7)

4.1.1 Input Format

The input contains only one line. It contains a series of card which represents Twisted Fate’s cards separated by several ”,”.

4.1.2 Output Format

True or False, depending on whether Twisted Fate had a Straight Flush in his hand(the input series).

4.1.3 Sample

Input[1]:

```
H3 , H4 , H5 , H6 , H7
```

Output[1]:

```
True
```

Input[2]:

```
SA , DK , SK , DQ , SQ , CJ , SJ , HT , CT , ST
```

Output[2]:

```
True
```

Input[3]:

```
SA , DK , SK , DQ , CJ , SJ , HT , CT
```

Output[3]:

```
False
```

5 Finale: DESTINY

The moment the woman raised her pistol and the Joker pulled out his dagger, Twisted Fate kicked the table off. Coins, cards and tickets flew from the gambling table to the air. The sound of the pistols was deafening, punching fist-sized holes in the table. The man with the eye patch felt only a tightening of the lasso in his hand. Twisted Fate took out the faintly discernible ♠A hidden in his sleeve, feeling his destiny in the chaos and scattered money in the sky.

By the time the dust had settled and the screaming had subsided, Mane pushed all the bodyguards around him away and stood up, but found his opponent was no longer there. His face bruised and furious, looking down and only saw the pieces of the table.

“Where’s my money?” Mane shouted, like an animal. *“Where is my damn money!”*

Only five cards left in Glory & Fortune Casino, faces up.

A sure bet.