

(Q) Grice's Grifter Gadgets (1/2) [10 points]

You are employed by a company that makes Grice's Grifter Gader (GGG), a small flying robot that helps you cheat at card games. The robot flies above your opponent's shoulder, looks at their cards, and then telepathically sends a message into your brain. (It's not the most ethical job in the world, but you took it because, hey, you get to work with **flying telepathic robots** — nobody could say no to that.)

These gadgets have to abide by the following maxims:

- **Relevance (R)** What GGG says should be relevant to the player's needs (winning at the card game); it should give the minimum number of facts necessary for the player to make the best play possible (telepathic communication isn't cheap!)
- **Manner (M)** In addition to giving the minimum number of facts necessary, those facts should be expressed as simply as possible
- **Quantity (N)** GGG should give all needed information, i.e. it should not leave anything out
- **Quality (L)** GGG shouldn't say things that are wrong (otherwise, what's the point of cheating)

Linguists believe that humans follow similar rules¹. For example, when you ask a friend what the weather is like, he would violate the maxim of quantity if he recited the hourly barometric pressure over the previous three days. Because the GGG communicates through telepathic natural language, it should also obey these maxims.

Here's the game GGG is trying to help a player win. Before each round, the dealer shuffles a deck with forty cards, where each card has one of four suits (club ♣, heart ♥, spade ♠, diamond ♦) and a number from 1 to 10. The player and her opponent each get three cards. The player picks one of her three cards and gives it to the opponent. The opponent gets points equal to the product of the two highest numbers in the same suit (if there are no cards of the same suit, the hand is worth one point). For example:

Opponent's Hand	Player Card	Points
4♥ 3♥ 2♥	1♣	4 × 3 = 12
4♣ 5♥ 9♦	6♣	6 × 4 = 24
4♣ 5♥ 9♦	10♠	1 (no cards of the same suit)

The GGG can't see the player's cards (it hovers above the opponent's shoulder), so it needs to give the player enough information for her to play the best card no matter what cards she has. For example, if the GGG sees that the opponent has a 4♣ 3♠ 2♦, it can't just say "play a heart", because the player might not have that in her hand.

¹ Language is ambiguous. In addition to the ambiguity of syntax and semantics, there are often social conventions that both speakers and listeners assume in a conversation. This was described by the linguist H. Paul Grice in the early 1960s. He proposed that speakers and listeners assume the maxims described in this problem.

Because of these maxims, conversation participants are able to make Gricean implicatures. These allow us to extrapolate from incomplete information. For example, if A asks B 'Where's Lisa?' and B replies 'Lisa got the flu,' the maxim of relevance allows A to assume that Lisa is staying at home *because* she is sick, even though this was never explicitly stated. Identifying and constructing these logical leaps in this restricted environment is the goal of this problem.



(Q) Grice's Grifter Gadgets (2/2)

Q1. What's wrong with my GGG?

You have to debug some defective units. Given an opponent's hand and the output of a GGG, give the maxims violated (use R, N, L, or M). Each example will violate one maxim.

Opponent's Hand	Output	Maxim Violated
4♥ 3♠ 2♦	He has a four of hearts, a three of spades, and a two of clubs.	
4♥ 3♥ 2♥	He has a four of hearts, a three of hearts, and a two of hearts.	
4♥ 3♦ 2♠	He has hearts, diamonds, and spades.	
6♥ 7♠ 3♦	He has a six of hearts, a seven of spades, a three of diamonds, and the sky is blue.	
2♠ 1♠ 3♣	He has an even prime number of spades, and the smallest odd prime number of clubs.	

Q2. Correcting the GGG

Given an opponent's hand, a maxim violated, and the output of a GGG, replace the underlined portion of the output with text that would fix the violation of the maxim (without violating any others!).

4♥ 2♦ 3♥	He has a four of hearts, a two of diamonds, and <u>a three of hearts.</u>	Relevance	
8♦ 2♦ 10♣	He has a ten of clubs and <u>an eight of spades.</u>	Quality	
8♦ 2♥ 10♠	He has an eight of diamonds <u>and a two of hearts.</u>	Quantity	

Q3. Playing the Game

Given the following statements by a (fully functional) GGG, give a configuration of the opponent's cards that is consistent with the statement and **all** the maxims (if there's more than one possible configuration, just give one).

- A. Don't play a heart.
- B. He has no hearts.
- C. He has clubs and hearts.
- D. He has a three of clubs and a two of spades.

