PROBLEM SET 13

FINE PRINT

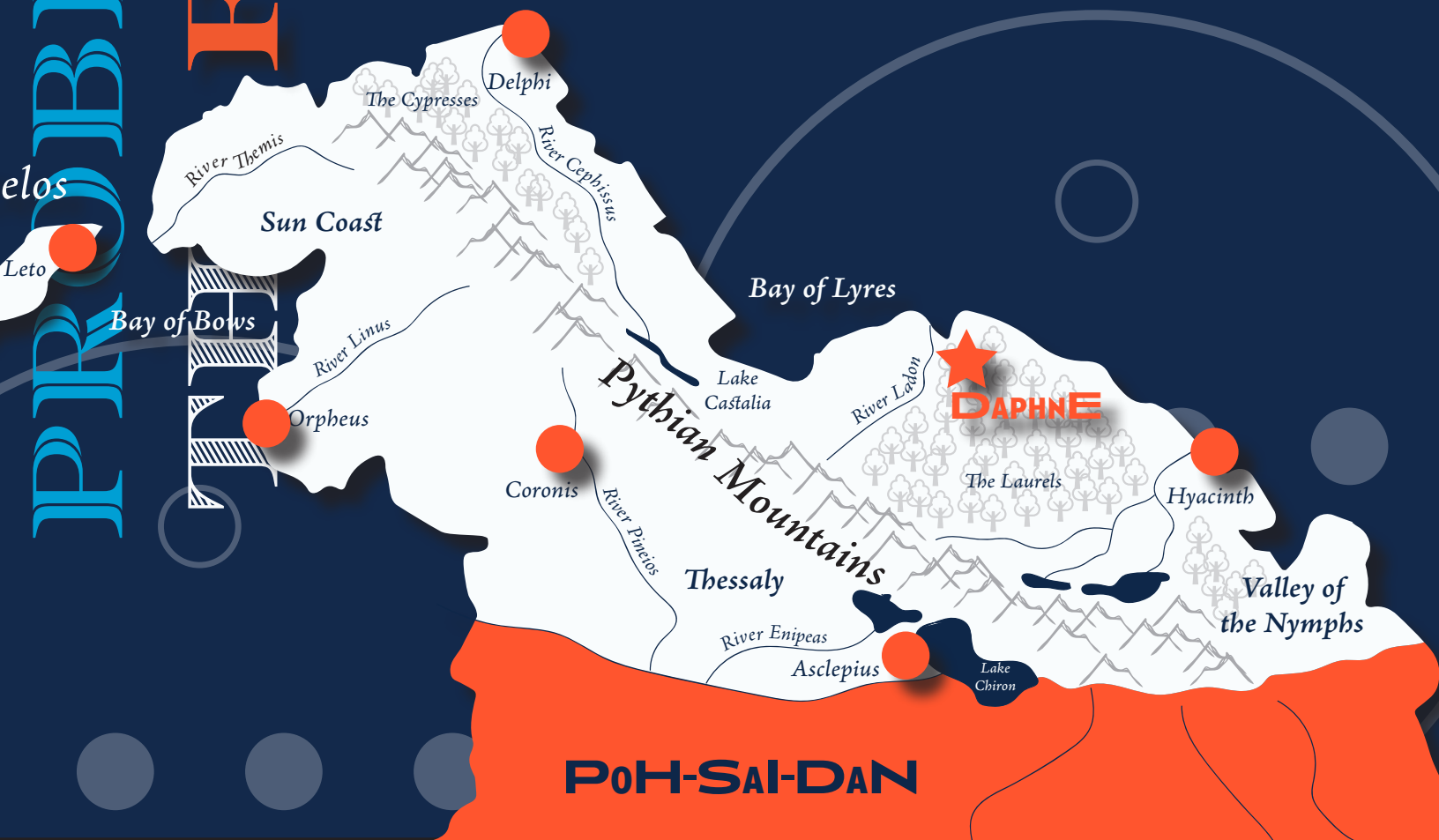
Socrates

Χαίρε, friend. Thanks for putting up with me while I've been hopscotching all over Olympia seeing colleagues. You'd be surprised how much that can wear an old idiot out.

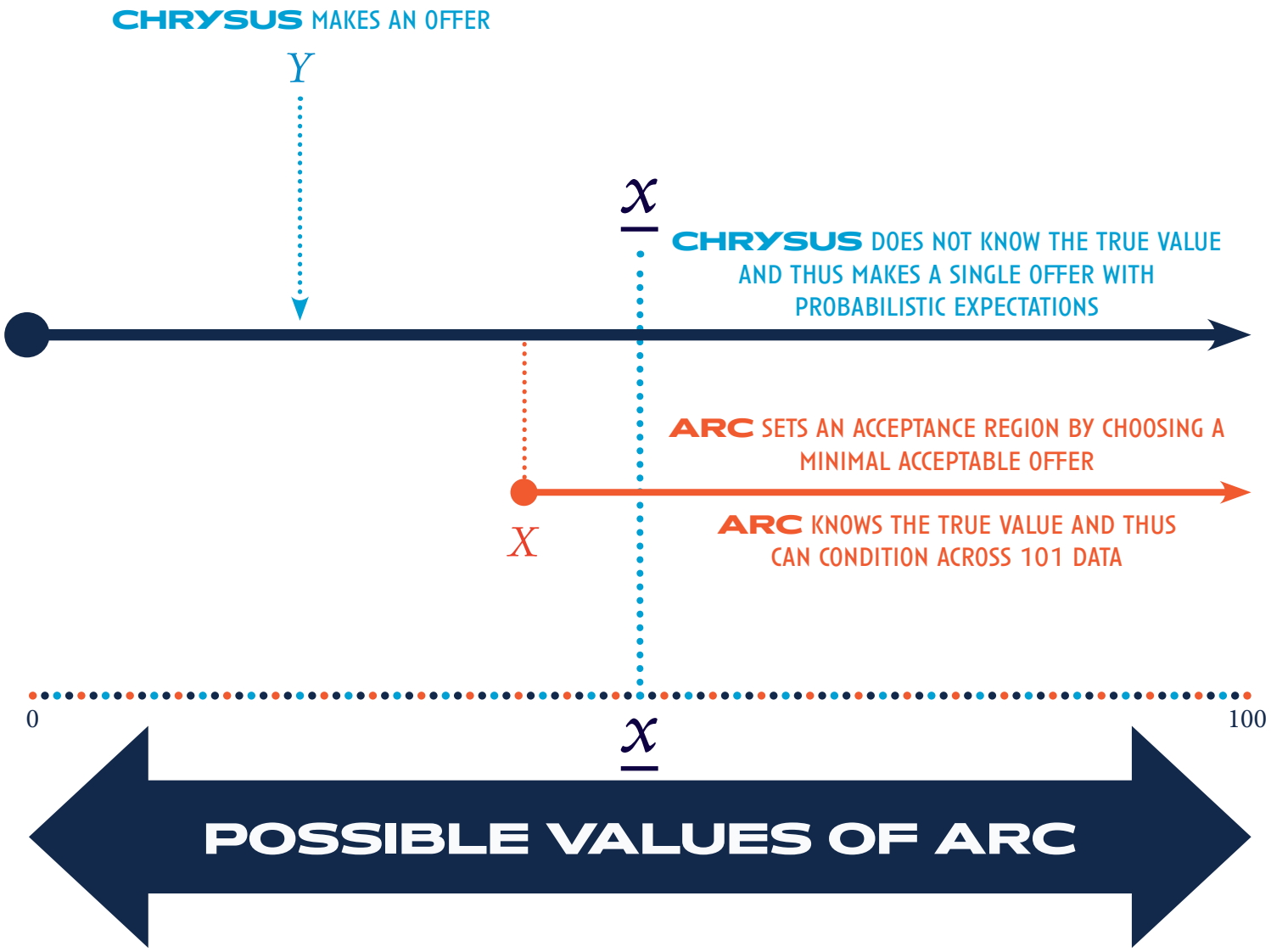
I've kept my eye on Chrysus's attempts to purchase Arc Industries at a reasonable price. It sounds like negotiations have been slow and tedious, but perhaps they're working their way toward finding common ground. It sounds as if Chrysus might be at a disadvantage during these negotations, though! He certainly looks that way, anyway—I've never seen such a smart guy look quite so confused, and I have to look in the mirror every day to blow dry this thing on my face.

I also had one of those strange dreams I have where I just come up with a random idea. It's going to be a really annoying one, but I feel like it might help us get to the bottom of something that's been bothering me. What, things about our strange language don't *bother* you?! What is the point of doing all this if you're not going to get *bothered* by one sort of thing or another?! *Being bothered is the best.* It reminds you that you're alive and passionate. Plus having a nemesis helps.

We're working very hard and coming to the end of our journey together. I hope that you're taking the time to rest and refresh. It's easy to lose sight of the wellness it takes to fuel insights. Please be good to yourself so that you can be good in general. I have faith in you—yes *you*.



PART 1 | THE TRIUMPH OF ARC?



You might remember the tension between Arc Industries and its potential buyer, Chrysus. Remember that Arc knows how much they're worth, which we will denote with $\underline{x} \in \{0, \ldots, 100\}$. Chrysus, on the other hand, has no idea, and thus make an offer with only their best guess about Arc's true value. The utilities of the game are as follows:

$$Y < X$$

[OFFER REJECTED]

$$u_A\left(X, Y; \underline{x}\right) = \underline{x}$$

$$u_C\left(X, Y; \underline{x}\right) = 0$$

$$Y \geqslant X$$

[OFFER ACCEPTED]

$$u_A\left(X, Y; \underline{x}\right) = Y$$

$$u_C\left(X, Y; \underline{x}\right) = \frac{3}{2}\underline{x} - Y$$

Clearly, we know way better than people putting actual money at stake...right? Maybe?

1. Is this a bargaining problem?
2. Which offers would Arc accept in case $\underline{x} = 25$?
3. More generally, for any true value $\underline{x}$, what is Arc's best response to an offer from Chrysus Y?
4. If Chrysus knew about this best response—which he doesn't, because he doesn't know $\underline{x}$—then what would his own best response be?
5. But since Chrysus doesn't know the true value, we should be a bit more realistic. What is his expected utility for making a particular offer Y, assuming that he assigns equal probability to each possible true value $\underline{x}$?
6. Which offer Y maximizes Chrysus's expected utility? How does his skill in improving the firm's value factor into this?
7. Using your answer from Question 2, figure out what Arc's best response to this offer is.
8. For each true value $\underline{x}$, what is Arc's profit? If they fail to make a sale, let's say that they have profit 0.
9. For each true value $\underline{x}$, what is Chrysus's profit? Again, if deals are rejected, assume profit 0.
10. How often does Chrysus report a loss?

necessary for **PASS**: get 6

sufficient for one **ALMA**: get 10

sufficient for another **ALMA**: think up a situation (other than buying a firm) where two parties make a deal under one-sided incomplete information. In 500-1500 words, discuss how the informational advantage helps the informed party (if at all). Does your answer depend on whether the informed party is the maker of offers versus the accept-er of offers?

PART 2 | THE MORE YOU KNOW...?

Now consider this little gadget of a game I dreamt up the other day.

	LEFT	CENTER	RIGHT
UP	1 2ε	1 0	1 3ε
DOWN	2 2	0 0	0 3

$1/2$

	LEFT	CENTER	RIGHT
UP	1 2ε	1 3ε	1 0
DOWN	2 2	0 3	0 0

$1/2$

There's no story for me to tell you about this one, but I still think there's a cool lesson lurking underneath its twelve squares and twenty-four numbers. But tastes differ, don't they?

1. Suppose first that Column player did not know the state of the world and had the same beliefs about the state of the world as Row player—namely, that both states are equally likely. **SQUISH** the game into a single strategic-form game using the relevant expected utility calculations across states of the world.
2. What is/are the pure-strategy Nash equilibria of the **SQUISH**ed game?
3. What is/are the associated utilities for the two players at these equilibria?
4. Now suppose that Column player knew the state of the world. Write out the best response for each type of Column player, where a "type" is just my way of saying "the state of the world."
5. What is Row player's best response?
6. What is the Bayesian Nash equilibrium of this game?
7. What is/are the associated utilities for the two players at these equilibria.
8. Could Column player make a credible promise to Row player to play Left? Why or why not?
9. Does more information always help?

necessary for **PASS**: get 6

sufficient for one **ALMA**: get 8

sufficient for another **ALMA**: in no more than 1000 words, describe what's going on here. What is driving this result, substantively speaking? You might want to think through the "credible promise" part of Question 8, and then think through what Row player would be thinking to themselves in light of an attempt to make such a credible promise.