[SQUEAKING]

[RUSTLING]

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FRANK SCHILBACH: Welcome to the mid-term review of 14.13. Tonight, as I mentioned before, there will be three types of questions on the exam. There will be true/false/uncertain questions. These are questions where you're given a statement, and you can ascertain whether the statement is true or false or uncertain.

True means essentially it's strictly true and it's always true, or false means it's strictly false, and there's a counterexample that's shows you it's false. And uncertain means like without having further information, you cannot actually answer the questions. So you cannot really make a statement whether that statement is true or false.

In any of the ones you do, please always explain your answers carefully. So just writing true, false, or uncertain will almost surely or will surely not give you full credit. You have to explain your answers. It doesn't actually matter that much whether you get it right, whether the statement is true, or false, or uncertain, as long as your answer is actually reasonable and shows some understanding of the material. So the quality of your answer is quite important.

We also want you to provide intuitions. We do not want you to just write some math and nothing else. You can use some math to sort of clarify your answer or the like, but you always need to provide a verbal explanation and some intuition and some explanation of why you think the answer might be or the statement might be true, false, or [AUDIO OUT] your answer.

For multiple choice questions, you're essentially given different choices, and you just pick one answer with no further explanation needed. Very simple. And then there will be sort of pset-style questions that sort of you're familiar with, either from like psets or like previous exams. These will be quite similar to the psets questions.

It will be sort of generally not on the harder side, just, you know, we only have so much time to do this. There will be some algebra involved. Again, please always explain your answers carefully.

Now, what materials are you responsible for? You're responsible for the lectures up to and including lecture 12, which was the lecture on March 11, up to slide 67 of lectures 11, or lecture-- the notes for the lecture, the handout of the notes for lectures 11 through 13. You're also responsible for recitations 1 through 5, recitations 6, now, which the recitation that Will gave, which is quite similar to this one, and 7. These recitations are just reviews that might be helpful for some of you. But there's no new material that we use that [INAUDIBLE] right now.

Psets 1 to 3 are sort of part of the deal. And readings, starred or non-starred readings cited in class are only relevant to the extent that they appear in lectures and/or recitation. But to say, like if I discuss a certain paper and the content of that paper, the content of the people that's discussed in the class is relevant to you. However, anything that's in the paper that doesn't appear in the lecture is not relevant, as in like, we're not going to ask you questions that sort of ask about some obscure details of the papers that you never heard about in class.

How do you get ready for the exam? Well, you study, study that the lecture and presentation slides carefully. You should make sure you're familiar and comfortable with the psets and the solutions make you understand and are able to solve the psets on your own. A great resource practice is to do those psets and exams.

Again, readings, starred and non-starred, are not required, but they may sort of help you deepen your understanding of the material, and maybe sometimes the lecture notes a little bit. [AUDIO OUT] dense and don't have that much detail. So you can sort of like try to consult them, and try to understand the material as best or better. But we won't ask you about the details of those readings beyond those details of was covered in class.

So let me now sort of review the material overall and sort of give you a sense of what are the kinds of things that we want to know. To be clear, this is not exhaustive in the sense of like, there are some other materials in the lecture slides that I'm not mentioning here. What I'm trying to do here is just give you a sense for a lot of what the most important key things that you should know. This will cover perhaps like 80%, 90% of the material that's actually potentially in the exam.

Having said that, you know you should really go through the entire lecture slides, make sure you're sort of gathering everything in understanding what's going on there. OK. So the first thing we discuss, these time preferences in particular, the exponential discounting model. Here, you should know, what is the exponential discounting model? What is delta, the time preference parameter that model?

What does it measure? How can we estimate it, assuming that an exponential discounting model is correct? Further, what are the main assumptions of exponential discounting model, and what evidence do we have against those assumptions? So lectures 3 and 4 discussed those assumptions and the evidence against these assumptions in detail.

And after that, we discussed the quasi-hyperbolic discounting model, which is a relatively small modification of the exponential discounting model. Again, you know what is this model? How is it different from the exponential discounting model? And of course, the difference is that there's a present bias parameter of beta that is added to this model, which measures short-run discounting, as in like, how much weight you put on the present, versus everything else that's in the future.

Now, what empirical evidence can the quasi-exponential, quasi-hyperbolic model explain better than the exponential discounting model, and why is that? So you should be familiar with, for example, things like preference reversals and then [INAUDIBLE] commitment. Why is that consistent with the quasi-hyperbolic model?

And you know, why is it not consistent with the exponential model? Of course, that's what we discussed in the previous slide, is the somewhat the assumptions of the exponential discount model, where for example, one of the key assumptions are that there are no preference reversals. And we discussed that in detail.

Then, of course you need to know in the course of hyperbolic discounting model, what is this sophistication? What is naivete? And what is partial naivete? So what does theta measure? What does theta hat measure?

What is full sophistication, full naivete, and partial naivete? And answer questions such as like, does sophistication make people always better off? And why, or why not, if that's the case?

Further, you should understand, what is demand for commitment? Who demands commitment and who doesn't? Or like are fully sophisticated or fully naive people, or partial naive people potentially demanding commitment?

What are the conditions under which somebody demands commitment? And what kinds of people do not, or do demand commitment? And what kinds of people benefit from doing so? And in particular, can people be worse off from being offered a commitment device? And why is that, or why not?

Next, we discussed in quite a bit of detail empirical applications from a range of different settings. This is lecture 5 and 6. So we want you to be familiar with those empirical applications. You should understand why the quasi-hyperbolic model can explain or cannot explain some of the empirical evidence better than the exponential discounting model. And I think you know , kind of like why do we think quasi-hyperbolic model is a good fit for some of the empirical examples that I have shown?

Then you need to be able to solve problems. These are similar problems to the problems in the problem sets that you have seen before, problem sets for people either like exponential discounters, or like for beta delta equals, where beta equals 1, and delta being like either 1, or 0.95, or close to 1, because hyperbolic discounters, and again, fully naive, fully sophisticated, and partially naive agents.

How does one solve such problems? Of course, we had plenty of practice already in the psets in the term examples, also it's in the finals. So you should use backwards or forwards induction or iteration, depending on the kinks.

I sort of discuss this in slide 62 of lectures 3 and 4, and slide 37 of lectures 5 and 6. There's also a recitation that covers that in detail. So you should have plenty of practice of doing so.

Now, let me now give you some examples of what are some examples true/false/uncertain questions, and how should you answer them? So let me sort of just read the statements for you, and you can think about this for a second. And then we're going to give you the answer.

So consider individuals with beta delta preferences-- this is quasi-hyperbolic discounters-- who only differ by their present bias-- had like beta equals between 0 and 1. And suppose there's a commitment savings device available. Their willingness to pay for this commitment device strictly decreases in beta.

Now, is that a true or false statement? The answer is this statement is false. Now, why is that? Well, there's, again, like if you just click false, that's not going to give you full credit, even if, in fact, the statement is false. What you need to do is you need to sort of provide some further explanation.

Ideally, you'll provide us like a somewhat detailed explanation, so that you know if it's false, if you provide several examples, that's should better amount than just one. In this case, why is it false?

Well, A, individuals might be naive, right? So in particular, if people are fully naive, they will not be willing to pay anything for commitment devices. So regardless to the beta, willingness to pay will always be 0. So it would surely not decrease in beta.

Second, the commitment device may just not be effective at all. If the commitment device is useless, it doesn't matter what beta is, nobody will demand commitment anyway. And finally, even if individuals-- this is a little bit more trickier explanation, and I wouldn't necessarily expect you to know that answer-- but even if individuals are fully sophisticated and devices effective, the commitment device is effective, willingness to pay, it may not be strictly decreasing in beta.

And here's sort of an example. Well, if beta equals 0 or beta equals 1, then individuals would be willing to pay 0 for the commitment device, right? Because if beta equals 0, they don't care about the future. If beta equals 1, they just don't need any commitment devices. But in between, the willingness to pay might be positive for betas between 0 and 1.

That essentially means that willingness to pay would be an inverse U in beta. Again, that's a bit of a tricky answer. Like the third bullet point, we wouldn't necessarily expect you to know that answer. But you should be able to say or to answer reason one, or reason two in this specific case.

Second example statement-- fully sophisticated individuals can experience large welfare losses from their present bias. The answer is this is true. Why is that? I'll let you think about this for a second.

Well, the answer is that awareness of present bias, that is, like sophistication, does not remove present bias. Even if people are sophisticated, the present bias is still there. There might be some commitment devices, some ways in which people are able to overcome the losses associated with present bias. But in the absence of commitment devices, people may still make suboptimal decisions. And some of these decisions might, in fact, induce large welfare needs.

We discussed some examples in class, sort of numerical examples, where you could see that sophisticated people might actually be worse off than naive people, and could in fact suffer quite a bit from or similar to the large welfare losses. With the present bias, all of this is evaluated by the long-run [INAUDIBLE] ideas of like if somebody makes choices for the future where the beta is not relevant, compared to that kind of welfare criterion, people might be a lot worse off due to their present bias.

OK, here's example number three. Present bias individuals always have positive demand for commitment devices. Again, the statement is false. Why is that? And we kind of discussed this already in the previous questions.

Now, let me be very explicit. There's sort of three conditions that must be met for positive demand for commitment. I discussed this in class.

We know that person must be present biased, or have some form of some self-control problems. Individuals must-- the person must be aware of the present bias, so they can't be fully naive. They could be partially naive, but it can't be fully naive. And the individual must perceive the commitment device as effective in helping overcome the self-control problem.

That's to say, if somebody is offered a commitment device, and that commitment device is useless, well, there's not going to be any demand for commitment, particularly if the person perceives that the commitment device is useless. Notice that that person might actually perceive the commitment device to be effective, while in reality, it's not. So they might have some positive demand for commitment, even if the commitment device is in reality useless, because their beliefs are wrong, because of essentially some form of partial naivete. But it cannot be that the person perceives the commitment device as not effective, because then the person would just not demand it in the first place.

Now, that makes now the statement false. When only the first condition of the three is met, as in like the person's only present-biased, then we cannot be sure that there will be positive demand for commitment. And so the statement, as had been said, is false, because we said sort of like always have positive demand for commitment.

If it were without the always, then you could also answer uncertain, because then you would say, well, it depends on their naivete, or on the sophistication, or it depends on how effective the commitment device is. But the way the statement is written, it says like, always. And so now, you can easily come up with some counterexamples that show that the statement in fact is false.

The second topic that we discussed after time preferences was risk preferences, in particular expected utility. So here, you know, you need to have a clear understanding of what is the expected utility model? What is risk aversion? Why are people risk averse?

How is risk aversion specifically modeled in the expected utility model? What is the expected monetary value? And also things like what is concavity? What does concavity have to do-- what is the expected utility versus the expected monetary value? And what does the concavity imply for risk aversion in the expected utility model?

Then next, how can we measure risk aversion within the expected utility model? In particular, we discussed three types of ways of measuring risk aversion. We discuss certainty equivalents. We discussed choices from gambles. We also discussed insurance choices. This is the Sydnor paper.

And then, we discussed what is problematic about the estimates of risk aversion in the expected utility model. In particular, we discussed evidence that found that there tends to be substantial small-scale risk aversion, so when you give people small gambles, they tend to be quite risk averse or they tend to have a very quite high gamma.

But we know also from large scale choices that the risk aversion cannot be actually that high when people make these choices. People leave the house every day and engage in quite a few risks. In the long run, they hold stocks and so on. This must mean that their long run using sort of long-run choices, that implies essentially a relatively low gamma.

But since the expected utility model only has like one parameter, it cannot explain both of those features and sort of ignores this trouble. So essentially, if you try to match a small-scale risk aversion, then you need to have a very large gamma, high gamma. If you try to match large-scale risk aversion, you need to have a low gamma. And that sort of brings trouble, because you can't just explain both of those things. And sort of Matthew Rabin in Rabin & Thaler, as well as recitation 4 discuss this conundrum and this issue and in quite a bit of detail.

Next, we discussed Kahneman and Tversky's 1979 prospect theory. This is a seminal paper. And if you'd remember just a few papers from this class, this is one of the papers that you should really know about. So what evidence in Kahneman and Tversky is inconsistent with expected utility? Well, in particular, sort of several things in there, but you discuss mostly one feature, which is risk aversion in the gain domain, and risk lovingness in the loss domain.

And so, now, what are the most important points from Kahneman and Tversky's prospect theory-- this is sort of the proposed alternative to expected utilities. This is on slide 3 of 51 of lecture 9, where there's sort of three futures discussed there. One is like changes rather than levels are the arguments of the utility function.

Then there's loss aversion. So there's a kink of the utility function around the reference point. And there's diminishing sensitivity, meaning the utility function is concave in the gain domain or [INAUDIBLE] above the reference point and is convex. And the last domain would be below the reference point.

OK, so now, what does sort of this proposed alternative utility or value function look like? How does it incorporate the three features again? We sort of discussed this and this utility function in lecture 9 that talks about this in detail. Or the lecture talks about this utility function in detail.

One key question here, that is, how is the reference point determined? What are some candidate reference points? So one candidate would be the status quo. Another reference point candidate would be expectation. But there could be also other things, such as goal and aspirations. Recitation 5 discuss this a little bit, not in too much detail.

Then, we discussed empirical evidence, in particular, what empirical evidence of loss aversion do we have? We talked about small-scale gambles. We talked about the endowment effect, in particular. And then we discussed some applications in lecture 9.

So what are these applications? We discuss labor supply, the housing market, stocks, marathon running, and golf. So you should be familiar with these empirical applications from lecture 9. You should in particular understand why reference-dependent preferences can explain some of the empirical evidence that is showed better than the expected utility models.

You should understand, is some of the evidence that we see consistent with the expected utility model? And if not, why not? And why is the reference-dependent model-- in particular, which feature of the reference-dependent model can explain the loss. What are the features again? Changes rather than levels-- some reference point, reference-dependence, the loss aversion and diminished sensitivity, so which feature is actually important? Explaining things, we focused mostly on loss aversion.

What is not relevant is the deal or no deal evidence and the paper by Pierce et al. There's a couple of slides at the end of lecture 9 that I didn't really cover or didn't cover at all. So we're not going to ask any questions about that.

So now, how do you solve problems with reference-dependent preferences? You can see problem set 3, question number 1 had some questions about this. And again, there's additional psets and exam questions that you could practice with. So there are quite a few of those kinds of questions.

Now, here is sort of some example of a multiple choice question, which is-- so Maddie wrote this question, so Maddie, in fact, appears. And the question is, Maddie is writing a problem set for 14.13. She gets utility u of q from the number of questions she writes. She has reference-dependent preferences around the goal of writing 10 questions, with 10 as her reference points.

If you normalize the utility of 10 questions to 0, which of the following would be consistent with loss aversion? I'll let you have a look at this. So there's option A, u of of 8 equals minus 2, u of 12 equals 1. And number B, option B yields 8 equals minus 2, u of 12 equals 2. And then C is, option C is u of 8 equals minus 1, and u of 12 equals 2.

So which of those answers is consistent with loss aversion? The answer is option A. Now, why is that? Well, loss aversion sort of implies that losses hurt more than gains help.

So with preferences as in A, Maddie would have the utility cost of 2 from falling short of her goal of two questions, but only a gain of 1 util from exceeding her goal by two questions, right? So the goal of, the game of exceeding, of being by two questions above, so being two questions above gives her some gain of 1 util.

But the utility costs of falling short with two is twice as large, which just tends to be kind of like the evidence that you would see in loss aversion. And the other two examples don't have that feature. So really only answer number A is correct.

Second question. Maddie is walking home and passes a bakery unexpectedly. She decides to buy a pastry. For example, she looks at the pastry, and it looks really nice.

Prior to purchasing the pastry, her maximum willingness to pay for the pastry was P0. Then she runs into Alan-- this is our previous, excellent TA-- who asks to buy the pastry from her. She offers him the lowest price she is willing to accept, P1.

Which of the following comparisons between P0 and P1 is consistent with an endowment effect, P0 larger than P1, P0 equals P1, or P0 smaller than P1? The answer is answer number C. Why is that?

Well, the endowment effect says that people are-- when their willingness to pay, that is in this case P0, is smaller than their willingness to accept, when they accept. That is to say, being endowed with an item in this case, like a pastry, increases one's willingness to pay. That is to say, if somebody asks you to sell something that you own, you ask for more money than you're willing to pay in the first place when you don't own the item. And so the endowment effect will then predict that, or the endowment effect entails that now P1 is larger than P0, which is answer number C. So Maddie values the pastry more after she has bought it, compared to like prior to buying it.

The third broad set of preferences to be discussed were social preferences. We didn't quite finish with this, so we're not going to cover everything, in particular, not lecture 13. And the estimation part of social preferences, which will apart from choices, which will be at pset 4.

You should understand what social preferences are. You should also understand how can you measure social preferences? In lab games, we discussed at length the dictator game, the ultimatum game, and the trust game. You should also be broadly familiar, not in detail, but broadly familiar of what evidence do we typically find in dictator and ultimatum games?

For instance, in dictator games, people tend to give something like 20% to 30% of their share. People tend to be quite nice in those games. Now, then we discussed then like given that evidence, so given that people look quite nice in these types of games, there's also some other evidence people give to charity or things like that. Do we think that is evidence of people being generally nice to others because of poor altruism? Or if not, why not?

We discussed sort of three sets of evidence in particular. We discussed the costly exit or exit options in dictator games. So people essentially won't be able to leave the dictator. They rather sort of leave and give, and sort of keep the money. Or they're willing to pay some small amount of money to leave the dictator game and not having to face some other person, but it then feel compelled to give to others.

There was the option of hiding behind the computer. If a computer gives you the option to hide behind the computer to be mean to others, you might take advantage of that and actually be meaner than you would be otherwise. So altruism, or people's giving tends to go down quite a bit when they're able to hide behind the computer.

So both of those types of pieces of evidence are evidence of social image being important in giving. People care a lot about what others think, in particular what others think about them, and they don't want to upset others. And so if they're able to avoid those kind of situations, they might be able to-- they might want to do that, which would suggest that it's not really that they want others to do well in the sense that they really want others to have money or more money than before, but rather it's because of social pressure or social image concerns, people might give in dictator or ultimatum games.

Moreover, there's some evidence of self-image about people caring about what they think about themselves. They want to think of themselves as being a good person. And so the evidence of the moral wiggle room seems to suggest that these concerns are quite important. In particular, people are engaging in some behavior where they delude themselves that they are in fact nice, when in reality, they're not. So that's discussed in detail in the lecture.

Again, we will not ask, and so you should be familiar with this type of evidence. And you should be familiar why that sort of tells us that people are perhaps not as nice as you might have thought. They are just coming from like dictator or ultimatum games, or from like donations. We will not ask you about models that estimate social preferences. That will be in problem set 4, so don't worry about that. Sort of the stuff on [INAUDIBLE] and Rabin that's there, we will not ask you about that.

OK, so then here's another example of a true/false/uncertain question. Statement, if a person gives 0 in a dictator game, this is evidence that this person is selfish. Now, the answer is false. I think if you answer it uncertain, that would also be fine. Why is that?

Well, the person might give 0 to the other person in the dictator game and then donate the money to someone in greater need, right? And then that person is in fact really quite nice. Second, the person might be very poor relative to the other person in the game. So her marginal utility is just very high.

So now, even if you have like equal weights to your own utility and the other person's utility, since the marginal utility of giving $10 to yourself compared to the other person is way higher than the other person's marginal utility, you would just give everything to yourself. And that doesn't mean you don't care about others. It just means like, in fact, even if you were sort of like a social climber, you would give it to that person, because that person was like a huge meany, or the rich person just might not really need that money.

Looking at this more closely, actually, I think uncertain would be a better answer here, and not false. I just wrote this question fairly quickly. So if the question says-- if the question instead were to say, this is conclusive evidence that this person is selfish, then it would be false. Or this would be, this is clearly evidence where this person must be selfish, that would be false.

The way it's written right now, it's rather sort of uncertain, because we just don't quite know. It could be that the person is really selfish. Or it could be that the person-- it could be this evidence that the person is selfish. But it could be the other two reasons that I just mentioned.

OK, so now, finally, I'm going to give you a long question, or an example of a long question. And this is the question of laptop policies. We talked about a little bit earlier in class, in fact in the first lecture. And we had the first problem set about this. And this is sort of like an algebraic version of that kind of question.

So assume the 14.13 students are present biased with beta small than 1 and delta equals 0. All students have the same beta smaller than 1 and delta equals 0. But they differ in the value they derive from using laptops in class. L is constant for each student from class to class, but uniformly distributed across students on the interval between 0 and 1.

So some people have like a huge value of using the laptop in class. And others do not. Each lecture generates no immediate utility. So it's neither fun nor like annoying or the like. But it does give a benefit, a future benefit of V. So like you might learn something, or there's some things that might be valuable to you in the future.

Using a laptop reduces the long-run benefit by D. This might be like distractions, in particular. So you might be distracted during class when you use a laptop. So the future benefits are diminished by that. Maybe he had said something really insightful, you didn't pay attention, and so now, the benefits is B minus D if you use a laptop.

Both B and D are the same for all students. So there's no variation across students there. The only variation's coming from some students who really, really like using laptops for various reasons, perhaps because they like to surf the internet. Perhaps they're really in need of using laptops because that allows them to take proper notes.

So in summary, a student uses a laptop in class-- sorry, a student that uses the laptop in class gets immediate utility L and future, undiscounted utility of B minus D. And a student who does not use a laptop gets immediate utility of 0 and future discounted utility of V. So and now the social planner is not present biased and seeks to maximize the utility of 14.13 students from his perspective, OK?

First question. Show that students are just indifferent between using and not using a laptop in the current class if L equals beat times D. Explain why students with lower values of L-- so that's like L being lower than beta D-- don't use laptops in class, but students with higher values of L-- so L exceeds beta D-- do use laptops in class. OK, so now what we're going to do is we're going to write down the utilities from the two choices. That's essentially already given in the explanation, except for that we need to be careful of where the beta comes in, right?

So if students use a laptop in class, they get the immediate benefit of L. And then in the future, they get what's discounted by beta, which is beta times B minus D, right, because both B and D are very far in the future. These are the benefits, or the diminished benefits, B minus D, that they get in the future. L is in the present, so there's no beta here.

Instead, if someone uses no laptop, the students get 0. So there's no laptop benefits in the present. And the benefits in the future, the value of the lecture the future is undiminished, which means essentially, it's just V. So the person just gets 0 plus beta times V.

Now, students who are indifferent, by definition, have the same utility of using laptops and using no laptop. So we can essentially just equate those two things. Notice that like the beta times B is always there. So it sort of essentially just cancels. And then what we get is the person that's indifferent, for that person, L equals beta times D.

Now, students that choose not to use laptops will have low valuations L of using laptops, while students that choose to use the laptops have high L, right? If L is very large, then it exceeds beta times D. If L is very small, then L does not exceed, is smaller than beta times D.

So given the indifference condition, we have essentially, as I just said, students that do not use the laptop, L is smaller than beta times D. And students that use the laptop, for them, L is larger than beta times D. OK. OK, now question number two.

Now consider the policy that allows students to use laptops only if they sign up in advance to sit in a laptop section. This is a little bit different than we had in class, but it's a version, or something that I also considered, in fact, in previous years that that was what was used. Now, the question here is, why is L larger or equal than D, not L is larger equal than beta D, the threshold for opting in to the laptop section? OK?

So now this is a choice for people to choose not for the present, when they come to class, whether they want to use a laptop right now. But instead, they sign up in advance to sit in a laptop section for the rest of the semester. So essentially, people are in the present, and they choose for the future whether they can use laptops in class.

Now, the utility is now different. And the key difference is that the laptop benefits are now in the future, right? So the utility of using a laptop now again is 0 in the present. And this is-- again, we make choices in the present for the future.

There's going to be no utility in the present. There's no lecture right now, no laptop benefits and the like. And in the future, everything is discounted by beta now, because the person is present biased potentially.

So it's beta times L plus B minus D. The utility of not using a laptop is just 0 again. Like in the present, nothing happens. And then in the future, the benefits, as before, are beta times D. So the only thing that you prepare is choice, or these two options, the previous version, is the L now is discounted by beta. But before, it was not.

Let me just go back here. So here, you see the L was like sort of-- here, you see the L not discounted by beta. This is when people make choices for the present. Instead, here now, the L is discounted by beta, because that choice is-- the laptop benefits are in the future.

Now, we can do the same thing as before. Threshold for opting in is defined as like-- or you can say that's essentially the indifference conditions. You can just equalize the two, the utility of using the laptop or not using the laptop. And what you now get is that if L is larger than D, or larger equals than D, then the person uses the laptop. And otherwise, they do not.

Now, why does the threshold now change from beta D to-- sorry, from beta times D to D? Well, because when laptop use can only happen in the future, all benefits and costs are discounted at the same rate, and that that rate is beta.

OK, question number three. Assume there's no laptop policy at all. Show that if beta times D is smaller than L and smaller than D, the student engages in preference reversals. She prefers not to use the laptop in future classes but changes her mind while she's actually sitting in those future classes.

That's sort of essentially the typical behavior of present bias. People that, when they're present biased, for at least some parameter of constellations, people engage in present bias. So let's do the math and see what comes out here.

So when thinking about the future laptop use, this student's problem is identical to the problem in part B, sorry, in part 2. Why is that? Well, because she discounts time, both one and two periods in advance, by beta. Essentially, everything is in the future, so you just discount everything by beta. That's exactly kind of the choice that we just had.

So when thinking about future class, where thinking about opting in into a laptop section, the person makes a choice for the future. So here, when she thinks about any future choices, what really matters is essentially the value of the laptop is in the future, I mean back in like part 2 that we just solved.

Now, we know from part 2 that if L equals smaller than D, then she would like to not use the laptop, right? So we just solve for that in part number 2. But from part number 1, we know that if beta D is smaller than L, she will end up using the laptop when she's actually sitting in the future class.

That is to say, if she has a choice in any given class and shows up in class, she will say, oh, like using the laptop would be great. The same would be true of phones, by the way. And when she has a choice in any given class that happens right now, if beta D equals smaller than L, she will end up using the laptop in class. So that implies essentially like a preference reversal using these parameter assumptions. She prefers not to use the laptop in future classes but switches her mind or changes her mind when she's actually sitting in those future classes.

OK, question number 4. Explain why the fraction 1 minus beta D of the class uses a laptop in part 1, but fraction 1 minus D of the class uses the laptop in part 2. Why does a smaller share of the class use their laptop in part 2? All right, so now we're just essentially comparing part 1 and part 2. And I'm going to look at what fraction of people are actually using the laptop.

So we can sort of do the math version and think about why that answer makes sense. So in part 1, a student uses the laptop if L is larger than beta times D. If F is CDF of L-- and then started as a puritan thing, but to define F as the CDF of L. And then given the uniform distribution, the probability of L being larger than beta D is 1 minus the CDF 1 minus F of beta delta, which is in this uniform. It's just 1 minus beta D.

Now, likewise, in part 2, a student uses a laptop if L is larger than the D. So we have the probability of L being larger than D is 1 minus the CDF or the F of D, which is 1 minus D. So a smaller share uses the laptop in part 2, because the benefit of using a laptop is delayed and hence discounted by beta.

So why is that? Well, essentially, think about it like this. If somebody has beta equals 1, which is kind of equivalent to like part 2, where people made choices for the future, if you use a laptop-- so a share of people will like the laptop, because-- or like to use the laptop when making choices for the future, not because of self-control problems or the like, but just because they find lots of really helpful in taking notes.

Now, if then a person, in addition, is present biased and makes a choice for the present, that enhances the short-run benefits, because now the L is not discounted by beta anymore. And now, it's essentially, it's given sort of the benefit. It's in the present, and everything else beta is in the future.

And so that means essentially that when making choices for the present, the present benefits, the L, gets more weight relative to everything else, which is against the weight of beta less than 1. So now, if you are already, when making choices for the future, chose the laptop anyway, that implies that you also choose the laptop for the present.

Essentially, anybody who chooses the laptop for the future would also choose the laptop for the present. And now, there are some people essentially don't have like huge variations. They might not choose the laptop for the future, but they might choose it, they will choose it for the present because of their present bias. And therefore, then the fraction of people who choose for the present will be larger than the fraction of people who choose for the future, which we just showed using some algebra.

OK, then finally, why would the social planner prefer the opt-in policy to both the the policy of allowing students to choose whether to use their laptops and to banning laptops altogether? So let's think about through this, the opt-in policy, what does that really entail?

Well, the opt-in policy, as we said, is the planner is not present biased. So the planner would only want students with L being larger than D to use laptops. And so the opt-in policy, as we just showed above, achieves this. So that's great.

I know like a free choice policy instead, students with beta times D is smaller than L, smaller than D, will suboptimally use their laptops, and the social planner does not like this. On the other hand, banning laptops altogether is suboptimal because welfare is gained by allowing the students with the highest valuations, with L equals-- sorry, L larger than D to use laptops, right? So banning laptops is not great because essentially, there's some people who really would love to use their laptops regardless of present bias. And not allowing that is not great.

Free choice is not great, because essentially, once you let people choose any given day, temptation will sort of kick in, and some people will suboptimally use their laptops and just surf the internet all day, or all class, and not learn very much. And instead, the policy where people opt in for the future essentially achieves the objective of the social planner, who wants only students with L larger than D to use their laptops. And the social planner will be happy, and therefore prefer that policy over both free choice and over banning laptops.

So that's the end. That's all I have to say about getting ready for the exam. And I think you should prepare well and try to look at the materials. Please ask any questions in case things aren't clear.

Again, I have office hours on Friday, April 3 at 4:30 to 6:00. I emailed you about that. Pierre-Luc also has office hours from 1:30 to 3:30. Again, that's in my email. If you have questions, please let us know in particular on Piazza or during office hours.

But in any case, please do not worry too much about the exam. Try your best, and you will do great. But you know, even if you don't do great, you'll be fine. You will pass this class as long as you take the exam and write something that is remotely reasonable. Thank you so much. And I look forward to seeing you in class soon.