MIT 14.13 – Midterm Exam Spring 2020

April 6, 2020

- There is a total of 85 points in the exam, so if you spend roughly one minute per point, you will have plenty of time to finish the exam and submit your answers in time.

- What materials can you use?
  - You can use slides and notes from lectures, recitations, and psets. You can also use a calculator.
  - You CANNOT receive help from others while taking the exam (online, in person, or any other way).
  - You CANNOT try to find answers to the questions online other than the Learning Modules website.
  - You CANNOT try to find questions or answers online other than looking at existing Piazza posts.
  - You can ask PRIVATE Piazza questions to clarify things if you think that is important and/or if you face technical difficulties, but you CANNOT ask public questions on Piazza.
  - You CANNOT watch lecture videos during the exam.
  - Support animals are fine!

- **Honor code:** We trust you to follow these rules. Question 4 asks you to type your name as an electronic signature confirming that you followed the rules given above for taking them exam.

- While taking this exam, always keep in mind that you are a wonderful person regardless of your answers in this exam. You will pass this class as long as you try your best.

- Good luck!

QUESTION 1: True, False, or Uncertain [20 points]

Please answer EXACTLY five out of the following seven questions. If more than five questions are answered, we will grade only the first five questions according to the order below.

Please state whether each of the following statements is true, false, or uncertain. Always explain your answer carefully and concisely. Your score is largely determined by the quality of your explanation. You only need to give the intuition for your answer, not a formal proof.

1. (4 points) Being fully sophisticated rather than fully naive (for the same present bias β) can make individuals worse off in their choices.

2. (4 points) Suppose John is a quasi-hyperbolic discounter. Prior to this semester, he was fully naive, but attending 14.13 lectures caused him to become fully sophisticated. Taking 14.13 therefore removed John's present bias and he will not suffer from any of the negative consequences of present bias anymore.

3. (4 points) People often decline small-scale gambles with positive expected value. Expected utility theory can explain such behavior but doing so requires high values of estimated risk aversion parameters (γ). This in turn leads to absurd implications when considering larger-scale choices.

4. (4 points) Reference dependence can explain why the distribution of marathon finishing times exhibits bunching at 30-minute intervals.

5. (4 points) The Ultimatum Game allows researchers to identify whether proposers are generous or strategic.

6. (4 points) Many people care about what others think about them. Such social image concerns can be an important motivator of helping others, e.g. by giving them money.

7. (4 points) A health insurance company exploiting its customers' loss aversion might offer insurance products with very high deductibles and low premiums.

QUESTION 2: Multiple Choice [20 points]

Please select ALL of the correct answer options for each of the following questions. For each question, it is possible that none, some, or all of the options are correct.

1. (4 points) Which of the following behaviors can be consistent with quasi-hyperbolic discounting but NOT with exponential discounting?

   (a) Time inconsistency

   (b) Impatience for all time horizons

   (c) Demand for commitment

   (d) Short-run impatience and long-run patience

2. (4 points) Let Maddie's utility from owning x apples be $u(x)$. Maddie currently does not own any apples. Confronted with a gamble that offers x_H apples with probability p and $x_L < x_H$ apples with probability $1 - p$, suppose

$$p \cdot u(x_H) + (1-p) \cdot u(x_L) < u(p \cdot x_H + (1-p) \cdot x_L).$$

   Which of the following properties do we know FOR SURE this utility function for apples exhibits?

   (a) Risk neutrality

   (b) Risk aversion

   (c) Risk seeking

   (d) Loss aversion

3. (4 points) Alex has the following utility function:

$$u(x) = \begin{cases} 5\sqrt{x} & \text{if } x \geq 0 \\ -10\sqrt{|x|} & \text{if } x < 0 \end{cases}$$

   Which of the following properties do we know FOR SURE Alex exhibits?

   (a) Impatience

   (b) Reference-dependence

   (c) Loss aversion

   (d) Diminishing sensitivity

4. (4 points) Frank has 200 students, 100 stopwatches, and 100 baseball caps.

   - Suppose none of the students own stopwatches or baseball caps to start with.
   - Asking students to choose between different amounts of money and the two items, Frank finds that each student is (i) exactly indifferent between \$10 and a stopwatch, and (ii) exactly indifferent between \$10 and a baseball cap.
   - Frank then randomly gives the stopwatches and baseball caps to his students, until each student receives either exactly one stopwatch or exactly one baseball cap.
   - Frank then suddenly realizes that he needs lots of baseball caps and stopwatches, so he tries to purchase the items back from his students.

   Once students were given a watch or a cap, which of the following valuations, i.e. minimum prices at which students are willing to sell the items back to Frank, are consistent with the endowment effect?

   (a) Students given a watch are only willing to sell it back when offered at least \$3.

(b) Students given a cap are only willing to sell it back when offered at least $5.

(c) Students given a watch are only willing to sell it back when offered at least $9.

(d) Students given a cap are only willing to sell it back when offered at least $10.

(e) Students given a watch are only willing to sell it back when offered at least $15.

(f) Students given a cap are only willing to sell it back when offered at least $22.

5. (4 points) Evidence from various experiments shows that people give on average about 20 to 30 percent of the available money to the other person in dictator games. Such evidence could be interpreted as evidence of altruism, i.e. that people genuinely care about others. What kinds of evidence suggest that people might be motivated by more than just altruism?

   (a) Experiments that show people are loss averse

   (b) Experiments on moral wiggle room

   (c) Experiments that allow people to exit dictator games

   (d) Experiments that allow people to hide behind a computer

   (e) Experiments that show people are present-biased

QUESTION 3: Estimating Discount Factors [45 points]

Please make sure to explain your answers in this section carefully and concisely. Do not simply write an answer without an explanation of how you arrived at this answer. Answers without adequate explanation will not receive full credit.

You become interested in estimating the discount factors of your TAs, Maddie and Pierre-Luc, after learning about time preferences in 14.13. Through some clever interviewing of them, you obtain information about their preferences for consumption of chocolate over time (both Maddie and Pierre-Luc love chocolate!) from which you can back out their discount factors.

You start with understanding Maddie's preferences. Let the unit of time be one day and let Maddie's instantaneous utility from consuming x pieces of chocolate (on any given day) be $u(x) = \sqrt{x}$.

1. (5 points) Today (Monday), Maddie tells you she is indifferent between consuming 9 pieces of chocolate today (Monday) and 16 pieces tomorrow (Tuesday). Assuming Maddie is an exponential discounter, what daily discount factor, δ, does her statement imply?

2. (5 points) Today (Monday), Maddie now tells you that she is indifferent between consuming 9 pieces of chocolate tomorrow (Tuesday) and 9 pieces of chocolate in two days (Wednesday). Still assuming that Maddie is an exponential discounter, what does this statement imply for Maddie's δ?

3. (5 points) Can the exponential discounting model explain BOTH of Maddie's statements from questions 1 and 2 together?

4. (4 points) Why might the quasi-hyperbolic discounting model be a better fit to explain Maddie's preferences?

5. (6 points) Now assume that Maddie is a quasi-hyperbolic discounter with short-term discount factor β and long-term discount factor δ. Calculate the β and δ implied by her indifference statements in parts 1 and 2.

6. (4 points) Suppose Maddie has $\hat{\beta} = \beta = \frac{3}{4}$ and $\delta = 1$. Suppose further:

   - MIT Medical has come up with a test that allows you to check whether Maddie has eaten more than x pieces of chocolate on any given day. Using this test, you offer a commitment device to Maddie on Monday: if she eats more than x pieces of chocolate on Tuesday, she needs to pay you \$100.
   - The commitment device is effective, i.e. if implemented, it will reduce Maddie's chocolate consumption on Tuesday below what she would consume if not offered the device. When offered this commitment device on Monday, Maddie's willingness to pay for the device exceeds its price p, and you implement it for her.

   On Tuesday, will Maddie wish that she had not chosen the commitment device on Monday? If yes, does this mean that she made a mistake on Monday?

7. (6 points) Next you investigate Pierre-Luc's time preferences. Just like Maddie, Pierre-Luc's instantaneous utility from consuming x pieces of chocolate is $u(x) = \sqrt{x}$. As before, the unit of time is one day, and today is Monday.

   You know from previous investigative work that Pierre-Luc is a quasi-hyperbolic discounter with $\beta \in (0, 1)$, $\beta \leq \hat{\beta} \leq 1$, and $\delta \in (0, 1]$.

   You ask Pierre-Luc to predict his future choices:

- Today, Pierre-Luc predicts that, when asked tomorrow, he will be indifferent between 16 pieces of chocolate on Tuesday and 25 pieces of chocolate on Wednesday.
- Today, Pierre-Luc also predicts that, when asked tomorrow, he will be indifferent between 16 pieces of chocolate on Tuesday and 25 pieces of chocolate on Thursday.

Show that these choices imply that $\hat{\beta} = \frac{4}{5}$ and $\delta = 1$. What can you say about Pierre-Luc's β given the choices?

8. (6 points) When asked tomorrow (Tuesday), Pierre-Luc is in fact indifferent between 9 pieces of chocolate tomorrow (Tuesday) and 81 pieces of chocolate on Wednesday. What is his true β? Is Pierre-Luc a fully naive, partially naive/sophisticated, or fully sophisticated quasi-hyperbolic discounter?

9. (4 points) Suppose Pierre-Luc has $\beta = \frac{1}{3}$, $\hat{\beta} = \frac{4}{5}$, and $\delta = 1$. Is it possible that Pierre-Luc is willing to pay for a commitment device (the one from above or any other) that will surely NOT reduce his future chocolate consumption?

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