This exam has 25 points. There are six questions on the exam. Most of the questions are worth 4 points, but one is worth 5 points.

Put your answers to the exam on blank sheets of paper, preferably white. (They may be lined or unlined.)

You have the entire class period (that is, until **3:20pm**) to take this test.

After the test is over, e-mail your answers to me as soon as possible.

Answer the questions using as much precision and detail as the time allows. *Correct answers which are unsupported by explanations will not be awarded points.*

More exam rules:

- Turn on your smartphone Zoom video feed so I can see you and your computer screen as you work. I understand that when you have finished your exam, you might have to close your smartphone's Zoom app in order to take pictures of your exam to send to me. If you have not been able to send me your exam by 3:35, please turn Zoom on (either on your smartphone or on your computer) so I can see you and talk to you about any technical problems which are causing the delay.

- Any time during the exam, you can call me on my landline at 801-883-0134 if you have questions. (If it's busy, I'm talking to one of your classmates; just call back a bit later.)

- Take your exam using black ink.

- Write nothing within about 1/8 inch of the edges of the paper.

- Do not put the answer to more than one question on a single sheet of paper.

- Make sure that each of your answer pages has the question number on it near the top. For example, "Qu. 3" or "Qu. 2 continued" or "Qu. 3 page 2."

- You should send me your exam in the form of a single PDF file. Arrange your answer sheets in the correct numerical order before preparing the file.

- Put your name on the first page of your exam.

- E-mail the finished PDF file to `lozada@economics.utah.edu`.

  Scanning instructions over $\longrightarrow$

- Retain your original paper copy of your answers in case there are legibility problems. You may have to mail me the originals, though this is not likely.

Instructions on how to scan your exam with a smartphone.
   Android

Scan a document

1. Open the Google Drive app .
2. In the bottom right, tap Add .
3. Tap Scan .
4. Take a photo of the document you'd like to scan.
   - **Adjust scan area:** Tap Crop .
   - **Take photo again:** Tap Re-scan current page .
   - **Scan another page:** Tap Add + .
5. To save the finished document, tap Done .

iPhone

Step 1: Locate the Files app on your phone. That's where you can view all of your iCloud files so you're not dancing the document shuffle.

Step 2: With the app open, select the iCloud Drive location.

Step 3: Swipe down on the screen and tap the three-dot More icon.

Step 4: Select New Folder, name your folder Scan and then tap Done.

Step 5: From your new Scan folder, swipe down again to tap the three-dot More button and select Scan Documents to activate the camera.

Step 6: Position the document on a surface and hover the phone above it until it's recognized by the Camera app. The document is highlighted in blue. Most often, the app will take the photo automatically, but there's also a shutter button in case it doesn't grab your document right away.

Step 7: Tap the Save button and your scan goes into the Scan folder, where it will be visible everywhere you can access iCloud. From there, you can tap the document to rename it.

Scanning multiple documents in sequence

Step 1: Arrange your documents in a stack so they're scanned in order, one after the other.

Step 2: After the camera shoots the first page, the app reads *Ready next scan* along the bottom. Remove the first page so it can capture the second page.

Step 3: Repeat Step 2 until you finish all scanning.

Step 4: Tap *Save* and all your scanned pages will save to a single document. A badge will indicate how many pages are included.

Don't worry about getting the scanning angle right, as the app will automatically correct the view to flatten the scan. When you view the finished scans, they will be properly aligned with a high-quality representation of the contents.

After completing your scan, there are even more options you can tweak. Just tap on the page at the bottom left and use the trash can icon to delete a page completely. The *Retake* button lets you fix a single page in a series without having to restart a multi-page scan. You can further crop or alter the document edges, use a filter, or rotate it so it looks exactly the way you want it.
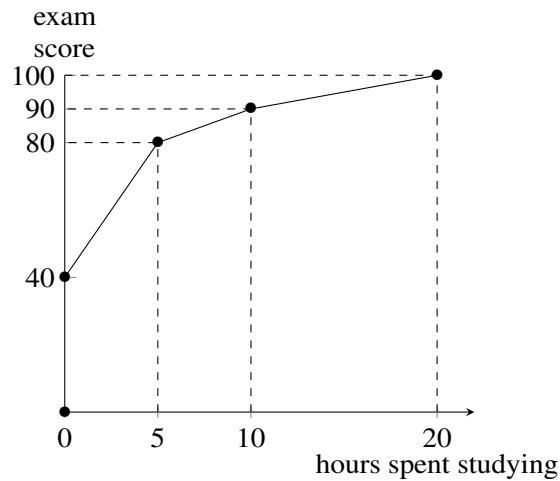
exam
score

Figure 1.

Answer all of the following six questions.

1. **[4 points]** Figure 1 shows a hypothetical relationship between the hours a student spent studying for an exam and the score which the student made on the exam. Using this Figure, illustrate the difference between the concepts of "marginal" and "average." You only need to give one instance in which marginal and average are unequal.

2. **[4 points]** In class, we discussed the following ideas, which are connected to the "Arrow Impossibility Theorem."

   - Complete: either $A \succeq_s B$ or $A \preceq_s B$.
   - Responsive to Individual Preferences: if $A \succ_s B$, then some individuals' ranking of A goes up and no one's ranking of A goes down, then it is still the case that $A \succ_s B$.
   - Nonimposition: if $A \succ B$ is true for someone and $A \prec B$ is true for no one, then $A \succ_s B$.
   - Nondictatorship: it is not true that "$A \succ_s B$ if and only if $A \succ_i B$ for individual i."
   - Independence of Irrelevant Alternatives: if $A \succ_s B$ when the choices are A, B and C, then $A \succ_s B$ when the choices are A and B alone.

1

Box 9.2 Comparing perceptions of risk: experts *vs.* the public

US Environment Protection Agency Scientific Advisory Board Unranked Priorities	US Public Opinion Poll March 1990 % Saying 'very serious'	UK Public Opinion Poll May 1989 % Saying 'very worried'
Ecological risks		
Climate change	48	44
Ozone layer	60	56
Habitat change	42	45
Biodiversity loss	n.a.	45
Health risks		
Criteria pollutants[a]	56	34–40
Toxic air pollutants[b]	50	33
Radon	17	n.a.
Indoor air pollution	22	n.a.
Drinking water	46	41
Pesticides	52	46
Issues regarded by the public as important but not by the experts		
Oil spills	60	53
Hazardous waste sites	66	n.a.
Industrial water pollution	63	n.a.
Nuclear accidents	60	n.a.
Industrial pollution accidents	58	64
Radioactive waste	58	58
Leaking undergound storage tanks	54	n.a.
Contaminated bathing water	n.a.	59

Sources: UK Department of the Environment (1991); *Science* (1990).

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Figure 2.

What do the mathematical symbols in these sentences mean? What is the Arrow Impossibility Theorem and what is its relevance to this course?

3. **[4 points]** In class, we discussed eight potential disadvantages of the Contingent Valuation Method. Describe three of them.

4. **[4 points]** Your textbook contains Box 9.2, reproduced here as Figure 2. What point are the authors of your textbook making by including this Box? Explain why one might today be skeptical about their point of view.

5. **[5 points]** Using a graph with "output" on the horizontal axis and "$/unit" on the vertical axis, explain the Coase Theorem. [Don't forget Question 6 on the next page.]

2

6. **[4 points]** What is the difference between an emissions charge and a user charge? (Hint: Do not confuse a user charge with a product charge.)

Answers to Exam 1, Econ. 3250, Spring 2021

1. The marginal increase in "exam score" that occurs when "hours spent studying" increases is the "change in exam score" divided by the "change in hours spent studying."

   The average at a particular "hours spent studying" is the corresponding "exam score" divided by "hours spent studying."

   The results in the following table. (The question only asks you to supply one instance in which marginal and average differ, so you did not have to supply this entire table.)

Hours	Marginal	Average
0		$40/0 = \infty$
0 − 5	$(80 - 40)/(5 - 0) = 40/5 = 8$	
5		$80/5 = 16$
5 − 10	$(90 - 80)/(10 - 5) = 10/5 = 2$	
10		$90/10 = 9$
10 − 20	$(100 - 90)/(20 - 10) = 10/10 = 1$	
20		$100/20 = 5$

   Therefore, the "average" in this graph is greater than the corresponding "marginal" for each of the ranges in this graph (0–5 hours, 5–10 hours, and 10–20 hours).

   The "average" is defined at each point in the graph. I have calculated the "marginal" only between pairs of points in the graph. By drawing tangent lines on the graph, one could calculate the marginal at each point in the graph. Since the graph is made up of straight lines, each tangent line would lie on top of one of the line segments making up the graph. This would make it easy to calculate the marginal value at each point, except at points 5 and 10, where the line has a kink, making the marginal value different just left of the point and just right of the point.

2. Spring 2017 Ex. 1 Qu. 2

3. Spring 2010 Ex. 1 Qu. 4

4. The authors' point, particularly in the lower part of the Box ("Issues regarded by the public as important but not by the experts"), is that experts and the general public disagree about the level of danger posed by the various environmental problems listed in the Box, and

that, in particular, experts think these problems are less likely to cause problems than the general public is. The author's subtext is that since experts are more knowledgeable about these issues than the general public is, the experts' opinions are more accurate than the general public's opinions.

There is reason to be skeptical about this position. In other words, there are reasons to think that the general public's perceptions of at least some of these risks was more accurate than the experts' perceptions. Since your textbook was written, consider "Oil spills," the first row of the bottom part of the Box: the 2010 *Deepwater Horizon* oil spill in the Gulf of Mexico " is regarded as one of the largest environmental disasters in American history" according to Wikipedia (`https://en.wikipedia.org/wiki/Deepwater_Horizon_oil_spill`). Or consider "nuclear accidents," the fourth line, in relation to the Fukushima Daiichi nuclear disaster in Japan in 2011, the second-worst nuclear accident ever (in terms of population evacuated) (see `https://en.wikipedia.org/wiki/Fukushima_Daiichi_nuclear_disaster`). One could cite additional recent examples of other problems mentioned in the lower part of the Box. Experts may have reasons to be unduly optimistic about how dangerous the industries in which they work are.

(The upper part of the Box shows that the US Environmental Protection Agency thought some risks were important that most of the general public did not perceive as being important, such as radon, which only 17% of the public thought was important. So the Box's upper part shows issues worried about more by experts than by lots of the public in 1990 and 1991, while the lower part of the Box shows issues worried about more by the public than by experts.)

5. Spring 2015 Ex. 1 Qu. 6
6. Spring 2011 Ex. 1 Qu. 6 (hint added to question).