

Do NOT write your name anywhere. (Canvas will tell me who turned in the exam.) Take pictures of your answers and use your own software or <https://pdfcandy.com/> to create a PDF for each answer which requires an upload. If it is large, resize it to A4. Upload that to Canvas. Upload each answer as a separate file with that question. Failure to follow directions will cost you one point.

You are not allowed to use your books, notes, the internet, or other people when taking this test. You can use the internet to access Canvas and to convert your answers to PDF files. Nothing else.

If you run out of time or lose your internet connection, you can do a second submission. You do NOT have to redo the questions you already did. I will be able to see every submission. If you have problems, you can always contact me via Zoom or e-mail. If you use Zoom, open it in a new tab or window.

Failure to follow these directions will cost you 1 point. The test has 100 points (to be scaled up to 170 points) and is scheduled to take 50 minutes. Therefore, expect to spend 1 minute for every 2 points. For example, a 12-point question should take 6 minutes. I have it set up to only give you an hour and a half.

Show all work on all questions.

1) (8 points) For EITHER the function in Part A OR the function in Part B, what transformation $T(U)$ would you do? Prove it is a legitimate transformation and find out what $T(U) =$ as a function of G & M . Do NOT worry about finding the slope of the indifference curve.

A) $U(G, M) = 18G^{1/2}M^{1/3}$

B) $U(G, M) = 18G^{2/3}M^{3/4}$

2) (8 points) Note this question is only 8 points. Answer EITHER Part A OR Part B.

A) Find A^{-1} for $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$

B) Prove A is singular when $A = \begin{bmatrix} 2 & 4 \\ 6 & 12 \end{bmatrix}$

3) (14 points) For EITHER the production function in Part A OR the production function in Part B, find the gradient, ∇Q , and the Hessian $\nabla^2 Q$.

A) $Q(L, K) = \ln(L * K) + LK$

B) $Q(L, K) = 9K^{1/3}L^{1/3}$

4) (16 points) Solve EITHER the system of equations in Part A OR the equations in Part B using Cramer's rule.

A) $3X + 2Y = 500$ $4X - Y = 300$

B) $6X - Y = 500$ $2X + 4Y = 600$

5) (18 points) For EITHER the utility function in Part A OR the utility function in Part B, use the implicit function theorem to find the slope of the indifference curve. Do NOT do a transformation. Assume that the first variable is the one on the X-axis and the other variable is on the Y-axis. Find the value at the point (16, 16). What does that number tell you?

A) $U(\text{Gloves}, \text{Masks}) = 16G^{1/2}M^{1/4}$

B) $U(\text{Gloves}, \text{Masks}) = 24G^{1/3}M^{1/6}$

6) (36 points) Suppose that creating \$1 of electricity uses \$0.20 worth of electricity and \$0.10 of food. Growing \$1 of food uses \$0.20 of gasoline. Making \$1 of gasoline uses \$0.10 of electricity. Create the Leontief Input-Output matrix. Briefly state how you did it. You want to sell \$798 worth of electricity, \$1596 worth of food, and \$0 worth of gasoline. (You will only make enough gasoline for you to use in producing electricity and food.) Use that to setup $(I-A)x=b$. Then find $(I-A)^{-1}$ using the minor, cofactor, adjoint method. Use that to solve for how much of each you need to make.