1. (9) Suppose the rental rate of capital is 5, the wage is 20, and the production function is $3K^{2/3}L^{1/3}$. Construct a LaGrange equation so that you maximize output given a total cost of $6,000. (1) \[
\bar{\Pi} = 3k^{2/3}l^{1/3} + \lambda(6,000 - 5k - 20l)
\]

a. (3) Solve for the output maximizing levels of labor and capital.
\[
\frac{\partial \bar{\Pi}}{\partial k} = 2(\frac{2}{3})k^{\frac{1}{3}} - 5\lambda = 0 \\
\frac{\partial \bar{\Pi}}{\partial l} = (\frac{2}{3})k^{\frac{1}{3}} - 20\lambda = 0 \\
\frac{\partial \bar{\Pi}}{\partial \lambda} = 6,000 - 5k - 20l = 0
\]
\[
l = 100 \\
k = 800
\]

b. (2) Show whether the production function exhibits increasing, decreasing, or constant returns to scale.
\[
f(k, l) = 3k^{2/3}l^{1/3} \\
f(\alpha k, \alpha l) = 3(\alpha k)^{2/3}(\alpha l)^{1/3} = \alpha 3k^{2/3}l^{1/3}
\]

inputs by magnitude \(\alpha\), output \(\uparrow\) by magnitude \(\alpha\)

c. (3) Using a graph, illustrate the above problem (make sure to indicate what you are constrained to and what can vary).

Looking for isocost furthest from origin while still touching isoquant (fixed)
2. (3) Relate the concepts in the February 25th, 2003 Wall Street Journal article about the airline industry to the economic idea of either economies of scale or diseconomies of scale. As airlines got larger, labor costs increased (some argue both of units). Thus, everything else being equal \( \uparrow Q \rightarrow \uparrow URAC \) or diseconomies of scale.

3. (10) Suppose a monopolist has a total cost function equal to \( Q^2 - 20Q + 100 \) and faces a market demand \( P(Q) = 40 - Q \).
   a. (3) Solve for the profit maximizing quantity.
      \[
      \text{Profit} = TR - TC = (40 - Q)Q - (Q^2 - 20Q + 100)
      \]
      \[
      \frac{\text{Profit}}{\partial Q} = 40 - 2Q - 2Q + 120 = 0
      \]
      \[
      60 = 4Q \\
      15 = Q
      \]
      \[
      \text{Profit} = 25(15) - (15^2 - 20(15) + 100) = 350
      \]
   b. (4) Given your answer in a, explain the incentive to enter the market and whether entry will occur. Describe two barriers to entry and how they prevent entry.
      \[\text{Profit} > 0 \text{ yes incentive to enter, Enter will not occur b/c of barriers to entry.} \]
      As long as you explain how two barriers prevent entry, you will receive full credit.
      Answers will vary.
   c. (3) If you were the government and you wished to maximize total surplus for society, what price would you charge (you should list a number)? Explain.
      \[
      \text{Set price by } \text{MC} = D (\text{or MB}).
      \]
      \[
      4Q - 20 = 10 - Q \Rightarrow \boxed{Q = 20} \text{ This is where } 3Q = 60 \text{ MC of production equals MB of consumption, surplus max.} \]
4. (9) Consider the market for kidneys (like the example discussed in the text). If the market depends on donations only, there will be a vertical supply at the donated amount. If we allow people to sell their kidneys, then there is a supply curve that starts at the donated amount and then exhibits the law of supply.

a. (3) Provide an illustration of this market.

b. (3) Compare producer, consumer, and total surplus with the donation outcome and the "free market" outcome. Assume hospitals pay nothing for donated organs.

\[
\begin{array}{c|c|c}
\text{C.S.} & \text{Donation} & \text{Payment + Donation} \\
\hline
\text{PS} & \frac{A}{B} < \frac{ABD}{CE} \quad (\text{assumes } B > E) \\
\text{Total} & \frac{ABC}{ABCDE} < \frac{ABC}{ABCDE} \\
\end{array}
\]

c. (3) Given your answer in b, should the government allow the free market (or selling of kidneys) to exist? Explain. It only a trivial surplus argument, then yes. However, quality and other factors could be a great concern. Answers will vary, just explain.
5. Discuss the role of economic theory in the formation and enforcement of Antitrust Laws. Make sure to explain the economic consequences of monopolies. Also discuss whether these laws are very specific or if there is any room for interpretation.

Formation - welfare losses from monopoly prices/powers. More is naked.
Enforcement - help form opinion about harmful business practices, barriers to entry (or lack thereof)

Plenty of room for interpretation, no absolute figures on MS, nor any exact determination of contestability.

6. Use isoquants and isocosts for part a of this problem.
   a. Illustrate the relationship between short run average total cost and long run average total cost (assuming a fixed level of labor in the short run).

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\[ \text{SRATC} \quad \frac{\text{TC}_0}{Q_0} < \frac{\text{TC}_1}{Q_1} \]
\[ \text{LRATC} \quad \frac{\text{TC}_0}{Q_0} \rightarrow \frac{\text{TC}_2}{Q_2} < \frac{\text{TC}_1}{Q_1} \]
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b. List the relationship between short run average total cost and long run average total cost. State an intuitive explanation for this relationship.

Assume \( \text{ATC} \uparrow \), \( \text{SRATC} \uparrow \) faster than \( \text{LRATC} \), for some \( Q \uparrow \). Intuition:
In the LR, the firm can make adjustments in both labor and capital to lower average costs,