R. Congleton   **Microeconomics II**   **GMU**

1.   Identify and/or Define the following:

a. Monopolist   n. market failure
b. Natural Monopoly   o. Pareto optimal
c. Harberger Triangle   p. social welfare function
d. Price Discrimination   q. externality
e. All or Nothing Offer   r. technological externality
f. Entry Barrier   s. Pigovian tax
g. Contestable Market   t. Coase theorem
i. Stackelberg Duopoly   u. signaling game
j. Monopolistic Competition   v. principal-agent problem
k. Conjectural Variation   w. risk aversion
l. Bilateral Monopoly   x. pooling equilibrium
m. First Law of Welfare Economics   z. moral hazard problem

2.   Use an Edgeworth box to demonstrate a Walrasian equilibrium and the first law of welfare economics. Explain the key assumptions of this model-- its strengths and its weaknesses.

3.   Suppose that ACME is a monopoly firm which sells its output at a single price. ACME faces the following demand curve for its product. $Qd = 10000 - 0.2P$. Find ACME's profit maximizing output if its total cost function is $C = (0.1Q + 120)w$ where w is the wage rate.

4.   Construct an abstract version of 3 making the usual economic assumptions of a downward sloping demand curve and diminishing marginal returns in production. Total cost increase as the prices of its inputs increase.

a.   What partial derivatives are necessary to represent the assumptions of your model mathematically?
b.   Characterize the profit maximizing output of this monopolist.
c.   What additional assumptions do you need to assume (if any) to demonstrate that the first order condition characterizes a profit maximum?
d.   Use the implicit function theorem to characterize the profit maximizing output as a function of input prices.
e.   Intuitively, we expect an increase in input prices to cause an increase in the monopolist's price and a decline in his output. Can this be demonstrated from your initial assumptions?
  i.   Are any other assumptions necessary to demonstrate this point?
  ii. If so what are their economic meaning?

5.   Suppose that Apex enters Acme's market in the case where market demand is again $Qd = 10000 - 0.2P$. Apex's a cost function, $C = (0.1Q + 100)w$.

a.   Find the Cournot-Nash equilibrium outputs and profits of the two firms.
b.   Suppose that Acme anticipates Apex's entry, and adjusts its output beforehand to account for Apex's likely production. Compare this Stackelberg equilibrium with the original Nash equilibrium.

6.   Repeat 2, 3, and 4 using abstract demand and cost functions.

7.   Suppose that a monopolist, UNO, faces the inverse demand curve, $P = K - aQ$ where Q is the total supply of all firms in the market, and has a cost function $C = bQ$. Suppose that entry in this market occurs as in a symmetric Cournot Nash Model.

a.   Determine UNO's profit maximizing output and profit level.

b.   Now allow entry to occur. Entry implies that market output is NQ_f^* where Q_f^* is the equilibrium output of each of N firms in the market.   Determine the Nash equilibrium for two firms, for three firms, ... for N firms.
c.   Determine the profit levels associated with each part of "b."
d.   Determine the long run equilibrium in this market .
e.   How does this case differ from the usual case of monopolistic competition where competitors are prevented from selling the same products or perfect substitutes for firms already in the market (because of patent, copyright or trademark protection)?

8.   Suppose that Ichi sells its output in two markets. In one it faces an inverse demand curve of $P = 1000 - 5Q$ and in the other it faces the inverse demand curve $P = 800 - Q$. Ichi's cost function is $C = 30Q$.

a.   Determine Ichi's optimal pricing strategy, output level and its profit level.
b.   Contrast this with its single price profit maximizing output and profit levels.
c.   Does deadweight loss increase or decrease as a consequence of price discrimination?

9.   Develop a price discrimination model for a firm that sells its output in two distinct markets. Suppose that the markets have identical demand curves, but that one of the markets the firm faces competition from another local firm. Develop an optimal pricing/output rule for such a firm.

10. Patent, copyright and trademark protection create temporary monopoly power.

a.   Use a prisoner's dilemma game to represent the "free rider" problem that would plague innovators if these protections did not exist. (Assume the strategies are invest in R&D, copy result of innovative rivals.)
b.   How large must the rewards of monopoly privilege be in your game to solve this innovators dilemma game?
c.   Discuss how this reward would vary across markets and with technological innovation? Would a general decrease in the cost of innovation increase or decrease the need for monopoly privilege.

11. Develop an intertemporal (using present discounted value) model of investment in innovation or R&D. Show how changes in the probability of success, the marginal cost of resources used in R&D, and expected cost affect innovation investment levels. (Initially keep the model simple: with two periods, and an original and potentially cost saving technology whose probability of use in period 2 can be increased via R&D expenditures.)

12. Develop an economic model of crime, where criminals are rational *expected* net benefit (income) maximizers. Demonstrate that various economic and law enforcement variables in your model can cause crime to increase.

13. Use a two person two strategy matrix of payoffs to characterize the following situations:

a.   The Prisoner's Dilemma
b.   An externality problem, (i) where both parties over-engage in some externality generating activity (ii) where both parties under-engage in some externality generating activity.
c.   The Pork Barrel Dilemma: where coalitions favoring two negative net benefit projects in Nash equilibrium manage to get both projects adopted, although each would have been better off if neither had been built.

d. The Tragedy of the Commons: where uses of a common property resource tend to over utilize it, reducing both total output and each users own net output.

e. Free Riding: where a pure public good is to be provided.

f. Show how appropriate Pigovian taxes and/or subsidies can solve all these dilemmas.

14. Suppose that the logging industry is composed of 1000 producers of "logs" each with the same cost function $C = L*(aw + br - dE) + fL^2$ where w is the wage rate paid by firms in the industry, r is the rental cost of capital used by each logger, and E represents all external effects generated by tree cutting, waste disposal, and run off. *a, b, d,* and *f* are parameters determined by finding the economically efficient manner of production. The market demand for logs is $L^d = 10000 - .001P$. Damages from the externality are estimated to be $D = 1000E + 10E^2$.

a. Characterize the typical logging firm's supply function, and that of the market.

b. Characterize the market equilibrium in the case where the number of firms in the industry remains fixed. Is this market structure stable in the long run?

c. Characterize the Pareto efficient level of production.

d. Is there and externality problem? If so, how can it be ameliorated?

e. Graphically depict your results, the nature of the problem, and your proposed solution.

15. In driving around Northern Virginia, one observes that only about a third of all drivers use their turn signals. Since there are annual state auto inspections, this evidently is a consequence of driver choices rather than equipment failure.

a. Develop a model of a driver's independent decision to use his turn signal or not. (Remember that failing to use the turn signal is a crime and also increases the probability that one will be hit from behind.)

b. Contrast this level with that which maximizes social welfare, e. g. is Pareto efficient. Is there an externality problem here? Demonstrate and briefly explain your reasoning.

c. Does your model (in part A) explain why some people use their turn signals and others do not? Elaborate.

d. Graphically depict your results and the nature of the problem.

16. Suppose that firms may lobby a local government to receive a monopoly privilege. The probability of receiving an exclusive monopoly privilege is $P_i = X_i/\Sigma X_j$, where Xi is the amount spent by firm i. The profit associated with winning the exclusive franchise is Π.

a. Characterize firm i's optimal investment in rent seeking for the case where the opportunity cost of rent seeking by firm i is cXi, and i = 1, 2.

b. Find the two person symmetric Cournot equilibrium of this rent seeking game.

c. Determine both "a" and "b" for the case where there are N players in the game.

d. Determine whether or not the cost of rent seeking rises as N increases.

e. What is the Pareto efficient level of investment in this game?

17. Suppose that Al runs a small doughnut shop. He hires Bob to make doughnuts for him and run the cash register. Suppose that both Al and Bob have similar indirect utility functions defined over income and leisure, U = u(L, Y). Doughnuts are sold for P dollars/dozen and are produced via constant returns to scale. Bob is paid an hourly wage, W, and penalized amount, F, whenever he is caught shirking by Al. The probability that Bob is caught increases with the amount of shirking that he engages in and with the time Al spends monitoring Bob at the shop. Shirking reduces Al's profits by increasing his costs.

a. Determine Bob's "shirking function." Is there a principle agent problem here? Explain briefly.

b. Find Al's ideal monitoring level in the case when he knows Bob's propensity to shirk.

c. Discuss Al's hiring problem. How can he attempt to find the "best" agent that he is willing to hire? (about 2-3 short paragraphs)

18. Suppose there are two students, Al and Bob, with indirect Cobb-Douglas Utility functions: $U_A = L^a Y^{(1-a)}$ and $U_B = L^{2a} Y^{(1-2a)}$ defined over leisure, L, and income, Y, where 0< a < .5. Suppose that Apex is interested in hiring only relatively ambitious workers (type "1" workers rather than type "2" workers).

a. Is there a single wage rate that can generate a pooling equilibrium in this case?

b. Is there a work week - labor income combination that will yield a separating equilibrium?

c. Contrast your results for "a" and "b" for the case where the alternative to working for Apex is working at another firm at wage rate w° for as many hours as desired, or not working at all.

d. Suppose that the firm produces via constant returns to scale. Which of these offers is more profitable for Apex? Explain.

19. A society that has a strong work ethic will clearly have greater material output than one that does not, if labor is equally productive in the two societies, that is to say if the two countries have access to the same production technologies.

a. Explain why the society with the work ethic may also be *more* efficient than its more leisurely counterpart. (Can such a society be less efficient?)

b. Now consider patterns of migration between these two countries, perhaps Germany and Spain. If labor is subject to diminishing returns, what will be the pattern of migration in "case a."

c. Repeat "a" and "b" for the case where there is a positive labor externality, either because of opportunities for increased specialization, or because of large scale team production, only this time build a case favoring the society with the strong work ethic.

d. Critics of this sociological/ethical explanation of labor supply differences among individuals and societies argue that differences in wage rates and the marginal rate of substitution between labor and leisure are sufficient to explain all this, without recourse to a "work ethic." Thus, the work-ethic argument is unnecessary. Are they right? Defend or criticize this point of view.

20. Suppose that a lottery is to be played where the $50,000/year is to be collected each year for 30 years. Tickets cost $1/each. What is the expected net value of a ticket if the probability of winning is 1/50,000 and r =.08? if the probability of winning is 1/100,000 and r = .04?

21. Consider a profit maximizing firm that must make a production decision before its output price is known. The firms profit function is $\Pi = P X - cX^2$ where X is output, P is the actual price the output is sold at, and c is a cost parameter. The product cannot be stored so the total amount produced will be sold at whatever price obtains. (The output might be a skilled service, agricultural product like strawberries or a rapidly depreciating capital good like computer mother boards.)

a. If the firm maximizes expected profits, what output will it choose if P is uniformly distributed between L and H?

b. How does the choice of output vary with the mean and variance of the distribution of prices?

c. Characterize the highest price that a firm would be willing to pay to know the output price with perfect accuracy. Explain your analysis and conclusions.

d. How would risk aversion by firm owners affect your analysis?