EC701: Adv. Microeconomics **Study Guide II** **RD Congleton**

WVU **Fall 2026**

This study guide is to help you prepare for the end-term exam on November 18. Before going through this study guide, I suggest that you look over the homework problems that have been worked since the midterm (HW 5–8). They are directly from the class materials. Most of the problems below are also from the class materials—but a few go beyond the material directly covered this semester and will not be on the end-term exam, although they might be asked on the micro prelim. These are collected in the last section of the study guide. The study guide also includes some problems from the first part of the semester—as a useful review—but which are not likely to be on the end-term exam. Remember that you may bring one page of handwritten notes to the exam.

I. Basic Concepts

1. Identify and/or define the following:

a. Present value
b. Expected value
c. Expected utility
d. Risk aversion
e. Risk premium
f. Risk pooling
g. Knightian risk
h. Knightian uncertainty
i. Entrepreneur
j. Creative destruction
k. Innovation
l. Rational ignorance
m. Latent demand
n. Nash equilibrium
o. Prisoner's dilemma
p. Mixed strategy
q. Stackelberg equilibrium
r. Moral hazard problem
s. Hobbesian dilemma
t. Rational criminal
u. Stationary bandit
v. Median voter theorem
w. Rent seeking
x. Internalized norm
y. Pareto optimal
z. Social welfare function
aa. Externality
bb. Technological externality
cc. Coase theorem
dd. First law of welfare economics
ee. Veil of ignorance

II. Time, Risk, Uncertainty, and Information (Chapters 6–9)

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

3. Suppose that Al has wealth of \$40,000 and a utility function $U = W^{0.5}$. There is a 10 percent chance that a storm will damage his house, which would reduce his wealth by \$30,000.
- **a** What is the expected value of Al's wealth? What is his expected utility?
- **b** Determine Al's certainty equivalent wealth and his risk premium. What is the most that he would be willing to pay for full insurance?
- **c** Use a diagram to illustrate your results. Label the expected value, expected utility, and risk premium.

d Explain why an insurance company that sells many such policies can profitably offer Al insurance at a price below his maximum willingness to pay. (Hint: what happens to the variance of the average loss as the number of policies increases?)

e Does Al's Arrow-Pratt measure of risk aversion rise or fall with his wealth? What does this imply about the demand for insurance by wealthy and by poor persons?

4. Suppose that Alice has a utility function $U = u(Q^H) + v(Q^L) + w(Q^O)$ with U being strictly concave and twice differentiable. Alice is purchasing two vegetables from a local farmer. The first is one whose quality is a bit uneven and varies between L and H with probability of the lower quality unit, L, being F. She cannot discern the difference between L and H units at the point of sale. The other vegetable is Q^O, whose quality is known with certainty when she purchases it. She has W dollars to allocate between the two goods, whose prices are P_1 and P_2 respectively.

a Characterize Alice's demand for the vegetable of uncertain quality.

b Does her demand curve for the vegetable of uncertain quality slope downward? (Show this mathematically.)

c How does her demand for that good vary with F? (Show this mathematically.)

5. Suppose that Acme is a price-taking firm with cost function $C = cQ^2$ that sells its output at price P. A regulation limits its output to Q_R units. The regulation is imperfectly enforced: both the probability of being caught, p, and the fine, f, increase with the extent of the violation, $(Q - Q_R)$.

a Write down Acme's expected profit function and characterize its profit maximizing output.

b Suppose that $p = a(Q - Q_R)$ and $f = b(Q - Q_R)$. Find Acme's output (supply) function. How does its output vary with a, b, and Q_R?

c Suppose instead that a fixed fine, F, is imposed with a fixed probability whenever $Q > Q_R$. Does such a fine affect Acme's expected marginal cost? Is it always irrelevant? Explain.

d How would a long delay between detection and punishment affect your analysis? (Hint: think about present values.)

6. Consider a profit maximizing firm that must make its production decision before its output price is known. The firm's profit function is $\Pi = PX - cX^2$ 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, an agricultural product like strawberries, or a rapidly depreciating capital good like computer motherboards.)

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 such distributions 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?

7. Frank Knight, Joseph Schumpeter, and Israel Kirzner each developed somewhat different theories of entrepreneurship.

a Briefly describe each theory. In what sense are Knightian entrepreneurs "uncertainty takers," Schumpeterian entrepreneurs "disruptors," and Kirznerian entrepreneurs "equilibrators"?

b Explain why entrepreneurial profits require Knightian uncertainty rather than mere risk.

c Suppose that an entrepreneur can invest I dollars in a new project that yields profit Π if it succeeds. Her subjective probability of success is F, and the normal (risk adjusted) rate of return is r.

Characterize her investment decision. Why might those who undertake such projects tend to be overly optimistic (a winner's curse)?

d Explain how Schumpeter's process of creative destruction can increase the number of goods available in a market economy, even though some goods disappear.

8. 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 (a) invest in R&D, or (b) wait and copy the results of innovative rivals.)

b How large must the rewards of monopoly privilege be in your game to solve the innovator's dilemma game? (Assume that the probability of a successful innovation is 0.10.)

c Discuss why this reward should vary across markets and with technological innovation. Would a general decrease in the cost of innovation increase or decrease the need for monopoly privilege?

d Develop an intertemporal (using present discounted values) model of investment in innovation or R&D.

e 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.)

9. Suppose that the price of a good varies among sellers and that Al does not know which seller has the lowest price. The more sellers that Al samples, S, the lower is the price that he expects to pay, p(S), although at a diminishing rate. Search is costly, with c(S) increasing at an increasing rate. Al's expected net benefit from purchasing Q units of the good is $N^e = b(Q, Y) – p(S)Q – c(S)$, where Y is his income.

a Characterize Al's ideal purchases and search effort.

b Use the implicit function theorem to determine how Al's search effort varies with his income. (Hint: the envelope theorem can be used to simplify your analysis.)

c Is Al rationally ignorant about prices? Explain.

d Explain why prices may differ among sellers even in equilibrium, contrary to the "law of one price."

10. Suppose that Bob has a Cobb-Douglas utility function $U = A^aB^b$ defined over the two goods that he knows about, A and B. He has W dollars to spend, and the prices of A and B are P_A and P_B.

a Find Bob's demand functions for A and B.

b Suppose that an entrepreneur introduces a new good, C, which Bob discovers that he likes. His utility function is now $U = A^aB^bC^c$. Find his new demand functions for A, B, and C.

c Compare your results for "a" and "b." How does the discovery of a new good affect the markets for existing goods? Is Bob better off after he learns about good C? Explain.

d In what sense did Bob have a latent demand for good C before it was introduced? Why might it be difficult for firms to estimate such demands?

11. Most people are rationally ignorant about most subjects and specialize in a few areas of knowledge.

a Explain the difference between natural ignorance and rational ignorance.

b Develop a simple two-period model of career choice in which a person first invests time in training for a career and then works. Assume that training requires a fixed amount of time and that the probability of earning a high wage increases with the time spent studying.

c Explain why fixed training costs tend to produce corner solutions, so that most people specialize in a single career rather than training for several.

d How do specialization and rational ignorance affect the extent of markets?

III. Game Theory and Strategic Interaction (Chapter 13)

12. Use a two-person two-strategy matrix of payoffs to characterize the following choice settings. In each case, identify the Nash equilibrium and determine whether it is Pareto efficient.

- **a** The Hobbesian 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** Tragedy of the commons: where users of a common property resource tend to over-utilize it, reducing both total output and each user's own net output.
- **d** The trading dilemma
- **e** The law enforcement dilemma
- **f** Free riding: where a pure or local public good is to be provided.

13. Not all 2×2 games are prisoner's dilemmas.

- **a** Use 2×2 payoff matrices to represent a coordination game, an assurance (stag hunt) game, and a game of chicken. Identify the pure strategy Nash equilibria of each game.
- **b** Find the mixed strategy Nash equilibrium of your game of chicken. Is it Pareto efficient?
- **c** Explain why the outcome of a coordination game may (1) produce conventions or other social norms and (2) also how such norms and conventions may contribute to the solution of new coordination games..

14. Suppose that firms may lobby a local government to receive a monopoly privilege. The probability of receiving an exclusive monopoly privilege is $F_i = X_i/\Sigma X_j$, where X_i is the amount spent on lobbying by firm i. The additional 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 cX_i, 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? Discuss.

15. Consider a prisoner's dilemma game that is repeated a known, finite number of times.

- **a** Use backward induction to determine the subgame perfect equilibrium of this repeated game. (See the appendix for a definition of sub-game perfect equilibria.)
- **b** Explain why cooperation may be possible when the game is repeated indefinitely, or when the players do not know when the game will end. (What does the folk theorem imply?)
- **c** Briefly discuss how this result might help explain self-enforcing contracts and the importance of reputations in markets.

IV. Law, Politics, and Markets (Chapters 14–15)

16. 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.

17. Suppose that Acme is a profit maximizing firm that faces a probability, T, that its output will be stolen before it can be sold. Acme's revenue is PQ if its output is not stolen and zero if it is stolen. Its costs, C = c(Q, w), must be paid whether or not its output is stolen.

- **a** Characterize Acme's profit maximizing output.
- **b** Show how an increase in the probability of theft affects Acme's output and its demand for labor.
- **c** How would an increase in theft affect the market price of Acme's product in the long run? Discuss how crime affects the extent of markets.

18. In driving around West Virginia, one observes that only about a fourth 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. However, using the signal consumes valuable time and attention.)
- **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.

19. Mancur Olson argued that a "stationary bandit" provides better governance than "roving bandits."

- **a** Use a game matrix to show why competing roving bandits tend to over-exploit the territory that they raid.
- **b** Suppose that a stationary bandit taxes each unit of output produced by the M firms in its territory at rate t. Each firm's output, Q = q(t, G), falls as taxes increase and rises at a diminishing rate with the bandit's spending on law enforcement, G. Characterize the bandit's net revenue maximizing tax rate and level of law enforcement.
- **c** Explain why a stationary bandit has an interest in providing some market-extending services, but generally not as many as would maximize the welfare of its subjects.

20. Suppose that a community uses majority rule to determine the level of a government service, G, which is financed with a proportional income tax. Voter i's utility is $U_i = u(Y_i - T_i, G)$, where Y_i is her income, $T_i = (Y_i/\Sigma Y_j)cG$ is her tax payment, and c is the marginal cost of G.

- **a** Characterize a typical voter's ideal level of G.
- **b** State the strong form of the median voter theorem. Explain why two pragmatic candidates will tend to converge to the median voter's ideal point.
- **c** Use the implicit function theorem to determine how the median voter's ideal level of G varies with her income. Can the demand for G fall as income increases? Explain.
- **d** Discuss some limitations of the median voter model. (Hint: what happens when policies are multidimensional, as in dividing a cake?)

V. Ethics, Norms, and Welfare Economics (Chapters 16 and 18)

21. A society that has a strong work ethic will clearly have greater material output than one that does not. Note that this tends to be ture if labor is equally productive in the two societies, which is to say if the two

countries have access to the same production technologies and labor has similar human capital with respect to ordinary skills.

- **a** Explain why the society with a strong 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"? (Assume that the average work week is longer (or more intense) in Germany than in Spain.)
- **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 the 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.

22. Suppose that a government has two law enforcement agencies: one enforces anti-fraud laws and the other enforces anti-corruption laws. The anti-fraud enforcer can accept a bribe, B, from a fraudster in exchange for not enforcing the law, and can share part of that bribe with the anti-corruption enforcer.

- **a** Use a game matrix to show why pragmatic enforcers are unlikely to enforce either law.
- **b** Add a virtue (or guilt) term to the payoffs of the anti-corruption enforcer that is large enough to solve this enforcement dilemma. How large must it be?
- **c** In the case of fraud in ordinary markets, ethics and law enforcement are substitutes. In the case of corruption, they are complements. Explain.
- **d** Briefly discuss how internalized norms might affect the demand for "virtuous" products, such as fair-trade coffee.

23. 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.

24. Suppose that smoke from Al's factory damages the laundry hung out to dry by Bob, his neighbor.

- **a** Use a diagram of Al's marginal benefits from production and Bob's marginal external costs to show the Pareto efficient level of smoke.
- **b** Show that if transaction costs are low, Al and Bob will negotiate to the efficient level of smoke whether Al has the right to pollute or Bob has a right to clean air.
- **c** How does the assignment of property rights affect the distribution of income in this case?
- **d** Why are transaction costs likely to be high when many persons are affected by an externality? What alternatives to Coasian bargaining are available in that case?

25. Suppose that there are N individuals in a community and two goods: a private good, X, and a pure public good, G. Each person has a utility function $U_i = u_i(X_i, G)$, and the community's resources, R, can be used to produce either good, so that $\Sigma X_i + cG = R$.

- **a** Characterize the allocation that maximizes a social welfare function, $S = s(U_1, U_2, \ldots U_N)$.
- **b** Show that the optimal level of the public good satisfies Samuelson's condition: the sum of the marginal rates of substitution equals the marginal cost of G. Does this condition depend on the particular social welfare function used?
- **c** Why are voluntary contributions likely to under-provide G? (Relate your answer to the free-rider game of problem 12.)

d Is the Samuelson condition also a condition for Pareto efficiency? Explain.

26. There are at least two ways to ground utility-based analysis. One—the one that originated with utilitarian philosophers—is that individuals tend to have an overarching goal of maximizing their lifetime satisfaction, which can be characterized with a utility function for many purposes. The other—the revealed preference approach, worked out a century later—does not assume that such an overarching goal motivates most decisions, but rather examines how a person behaves. If individual choices are internally consistent (transitive), then they can be characterized with a utility function and individuals can be said to behave "as if" they maximized utility.

a How do these two approaches differ in their predictions?

b For utilitarian welfare economics, the first approach is clearly more apt than the second. Explain why.

c Nonetheless, even if the first accurately describes the actual decision process of individuals, it is not clear that you can compare the utilities of two or more individuals. (It is not always impossible, as one might accurately determine what a close friend would want to do in a given situation—but that seems to require a lot of information about another's preferences.) Discuss briefly the limits of this approach and how Pigou's monetization of utility might help solve some of these problems.

d Do the Pareto criteria suffer from the same problems? Why or why not?

27. Contractarian approaches to normative analysis provide an alternative to utilitarian welfare economics.

a Explain how Rawls's veil of ignorance can be used to evaluate alternative public policies or institutions. Why are choices made behind the veil likely to be unanimous?

b Model the choice of a public service, G, by a typical person behind a veil of ignorance who does not know whether he or she will be rich or poor. (Assume that each income position is equally likely.) How does this choice differ from the median voter's choice in problem 20?

c How does Buchanan's veil of uncertainty differ from Rawls's veil of ignorance? What role does the status quo ante play in Buchanan's analysis?

d Rawls argued that persons behind the veil would choose using a maximin rule. Is this consistent with expected utility maximization? Discuss.

VI. Review Problems from Part I of the Course

These problems are a useful review of the first part of the semester, but are not likely to be on the end-term exam.

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

29. Construct an abstract version of problem 28 making the usual economic assumptions of a downward sloping demand curve and diminishing marginal returns in production. Total costs increase as the prices of 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 (if any) do you need 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 is their economic meaning?

30. Suppose that Apex enters Acme's market in the case where market demand is again $Q_d = 10000 - 0.2P$. Apex has 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. Find the resulting Stackelberg equilibrium.

c Compare this Stackelberg equilibrium with the original Nash equilibrium.

31. 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 examine the effects of entry. 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)?

32. 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 in one of the markets the firm faces competition from another local firm. Develop an optimal pricing/output rule for such a firm.

VII. Problems that Go Beyond This Semester's Material

These problems go beyond the material covered this semester and will not be on the end-term exam, but they might be asked on the micro prelim.

33. 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 shirking 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 Find Bob's shirking function. Is there a principal-agent problem? Explain.

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)

34. 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 separating equilibrium in this case?

b Is there a work week–wage rate 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^o 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.