Name: _____

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Intermediate Microeconomics — Practice Exam

Instructions: Part A: answer ALL 20 multiple-choice questions (2 points each). Each question has four options, A to D, of which exactly one is correct. Part B: answer ALL 5 questions (12 points each) and show your working. A calculator may be used. Time allowed: 120 minutes.

Time Limit: 120 minutes

Multiple Choice (20 questions)

[2 points] 1. Ana's preferences are represented by $U(x, y) = x^{1/3}y^{2/3}$. She spends all her income on 10 units of x and 40 units of y, and the prices are $p_x = 3$ and $p_y = 1$. Measuring the marginal rate of substitution as $MRS = \frac{MU_x}{MU_y}$, which statement is correct?

A. $MRS = 2$; she should buy more x and less y.

B. $MRS = 2$; she should buy less x and more y.

C. $MRS = 0.5$; she should buy less x and more y.

D. $MRS = 3$; she is already at her optimum.

[2 points] 2. Which of the following utility functions does NOT represent the same preferences as $U(x, y) = xy$ for positive amounts of both goods?

A. $V = \ln x + \ln y$

B. $V = (xy)^2 + 5$

C. $V = 3\sqrt{xy}$

D. $V = x^2 y$

[2 points] 3. A student has a monthly budget of 100 for mobile data (x, in GB) and a composite of other goods (y, price 1). Her plan charges 5 per GB for the first 10 GB and 2 per GB for every GB beyond 10. With x on the horizontal axis, which description of her budget line is correct?

A. Slope -5 up to 10 GB, slope -2 beyond, horizontal intercept 35 GB

B. Slope -2 up to 10 GB, slope -5 beyond, horizontal intercept 35 GB

C. Slope -5 up to 10 GB, slope -2 beyond, horizontal intercept 50 GB

D. One straight line of slope -3.5 and horizontal intercept 28.6 GB

[2 points] 4. Ben's utility is $U(x, y) = 12\sqrt{x} + y$. The price of y is 1 and the price of x is 3. How much x does he buy when his income is 50, and when his income is 80?

A. $x = 4$ at an income of 50 and $x = 6.4$ at an income of 80
B. $x = 2$ at both incomes
C. $x = 4$ at both incomes
D. $x = 16$ at both incomes

[2 points] 5. Clara always drinks a cup of coffee with exactly two units of milk, so her utility is $U(x, y) = \min\{2x, y\}$, where x is cups of coffee and y is units of milk. Her income is 60, coffee costs 4 a cup and milk costs 1 a unit. The price of milk then rises to 2. Which statement is correct?

A. Milk falls from 20 to 15 units, all of it a substitution effect
B. Milk falls from 20 to 10 units, half substitution and half income effect
C. Milk falls from 20 to 15 units, all of it an income effect
D. Milk stays at 20 units, because the two goods are perfect complements

[2 points] 6. At current prices and income, Dev buys 10 units of good x. His demand satisfies $\frac{\partial x}{\partial p_x} = -4$ and $\frac{\partial x}{\partial m} = 0.2$. Using the Slutsky equation, the substitution effect $\frac{\partial x^s}{\partial p_x}$ and the type of good are:

A. -2; x is a normal good
B. -6; x is a normal good
C. -2; x is an inferior good
D. -6; x is a Giffen good

[2 points] 7. Which statement about a Giffen good is correct?

A. Every inferior good is a Giffen good, since demand falls as income rises
B. Its substitution effect is positive, which is why its demand curve slopes upward
C. Its income effect is zero, as for any good with quasi-linear utility
D. It is inferior, and its income effect outweighs its substitution effect

[2 points] 8. A consumer has utility $U(x, y) = x^{0.3}y^{0.7}$. Her own-price elasticity, income elasticity and cross-price elasticity (with respect to p_y) of demand for x are:

A. $-0.3,\ 0.3$ and 0
B. $-1,\ 1$ and 0
C. $-1,\ 0.3$ and -0.7
D. $-0.7,\ 1$ and 0.3

[2 points] 9. A firm's production function is $f(K, L) = K^{0.3}L^{0.5}$. If it raises both capital and labour by 10 percent, output rises by approximately:

A. 8 percent, so the technology has decreasing returns to scale
B. 10 percent, so the technology has constant returns to scale
C. 5 percent, so the technology has decreasing returns to scale
D. 3 percent, so the technology has decreasing returns to scale

[2 points] 10. A firm produces with fixed proportions, $f(K, L) = \min\{K, 2L\}$. The wage is $w = 10$ and the rental rate of capital is $r = 4$. Its long-run cost function is:

A. $C(q) = 14q$
B. $C(q) = 24q$
C. $C(q) = 9q$
D. $C(q) = 4q$

[2 points] 11. A perfectly competitive firm has short-run total cost $C(q) = q^3 - 6q^2 + 20q + 50$. Below what market price will it shut down in the short run?

A. 8
B. 11
C. 20
D. About 24.3

[2 points] 12. In a perfectly competitive industry with free entry and exit, every firm has the long-run cost function $c(q) = 2q^2 + 50$ for $q > 0$, with $c(0) = 0$. Market demand is $Q = 500 - 10P$. In long-run equilibrium, the price and the number of firms are:

A. $P = 20$ and 300 firms
B. $P = 10$ and 80 firms
C. $P = 20$ and 30 firms
D. $P = 20$ and 60 firms

[2 points] 13. A monopolist faces a constant price elasticity of demand of -3 and has a constant marginal cost of 10. Its profit-maximising price and its Lerner index $\frac{P-MC}{P}$ are:

A. price 10; Lerner index 0
B. price 13.33; Lerner index 0.25
C. price 30; Lerner index 0.67
D. price 15; Lerner index 0.33

[2 points] 14. A gym has many identical potential members, each with demand $q = 20 - p$ for visits per month, where p is the price per visit. The marginal cost of a visit is 4. If the gym charges a monthly membership fee plus a price per visit, the profit-maximising tariff is:

A. a price of 4 per visit and a fee of 128
B. a price of 12 per visit and a fee of 32
C. a price of 4 per visit and a fee of 256
D. a price of 0 per visit and a fee of 200

[2 points] 15. Two cafés compete in prices, choosing them at the same time. Demand for café i is $q_i = 40 - 2p_i + p_j$, where p_j is the rival's price, and each café has a constant marginal cost of 10. In the Nash equilibrium, each café's price and profit are:

A. $p = 10$ each; profit 0 each
B. $p = 25$ each; profit 225 each
C. $p = 20$ each; profit 200 each
D. $p = 15$ each; profit 125 each

[2 points] 16. Four identical firms choose quantities at the same time (Cournot competition). Market demand is $P = 100 - Q$ and each firm has a constant marginal cost of 10. In the Nash equilibrium:

A. each firm produces 22.5 and the price is 10

B. each firm produces 18 and the price is 28

C. each firm produces 30 and the price is 40

D. each firm produces 11.25 and the price is 55

[2 points] 17. Row chooses Up or Down and Column chooses Left or Right, at the same time. In each cell of the table, Row's payoff is listed first. Which statement is correct?

	Left	Right
Up	4, 3	1, 1
Down	0, 0	3, 4

A. (Up, Left) and (Down, Right) are both Nash equilibria

B. Only (Up, Left) is a Nash equilibrium, because it gives Row its highest payoff

C. There is no pure-strategy Nash equilibrium, so both players must randomise

D. Up is a dominant strategy for Row, so (Up, Left) is the only equilibrium

[2 points] 18. In the game below, Row chooses Up or Down and Column chooses Left or Right at the same time; Row's payoff is listed first. In the mixed-strategy Nash equilibrium, Row plays Up with probability:

	Left	Right
Up	3, 1	0, 2
Down	1, 2	2, 0

A. $\frac{1}{2}$

B. $\frac{1}{3}$

C. none: the game has no Nash equilibrium of any kind

D. $\frac{2}{3}$

[2 points] 19. Ann and Bob share 10 units of x and 20 units of y in total. Ann's utility is $U_A = x_A y_A$ and Bob's is $U_B = x_B y_B$. Writing each person's bundle as (units of x, units of y), which allocation is Pareto efficient?

A. Ann (5, 5) and Bob (5, 15)

B. Ann (2, 4) and Bob (8, 16)

C. Ann (4, 12) and Bob (6, 8)

D. Ann (6, 6) and Bob (4, 14)

[2 points] 20. Smoke from a factory damages a laundry next door, costing the laundry 80 a day. A filter that removes the smoke would cost the factory 50 a day. The two firms can bargain at no cost. According to the Coase theorem:

A. the filter is installed only if the laundry holds the right to clean air

B. the filter is never installed, because the factory bears its whole cost

C. the filter is installed whoever holds the right; only who pays changes

D. the filter is installed only if the government taxes the smoke at 80 a day

Short Answer (5 questions)

[12 points] 21. Utility maximisation and the Slutsky decomposition. Maria spends her income m on two goods, x and y, with prices p_x and p_y. Her utility function is $U(x, y) = x^{1/4}y^{3/4}$. Initially $m = 160$, $p_x = 2$ and $p_y = 6$.

[3 points] (a) Set up the Lagrangian for Maria's problem and use the first-order conditions to derive her demand functions $x(p_x, p_y, m)$ and $y(p_x, p_y, m)$.

[2 points] (b) Calculate her optimal bundle and show that the tangency condition holds there.

[1 point] (c) The price of x rises to $p_x = 4$, with income and p_y unchanged. Find her new bundle.

[4 points] (d) Decompose the change in her demand for x into a Slutsky substitution effect and an income effect. State the compensated income you use.

[2 points] (e) Her demand for y did not change. Apply the same decomposition to y and use it to explain why.

[12 points] 22. Cost minimisation and the competitive firm. A firm produces output q with the production function $q = K^{1/2}L^{1/2}$. The wage is $w = 4$ and the rental rate of capital is $r = 9$. The firm sells its output in a perfectly competitive market.

[1 point] (a) What returns to scale does this technology have? Show why.

[4 points] (b) Use a Lagrangian to find the cost-minimising amounts of labour and capital needed to produce q units (the conditional input demands), and hence the long-run cost function $C(q)$.

[3 points] (c) In the short run capital is fixed at $\bar{K} = 16$. Find the short-run total cost, marginal cost and average cost functions. At what output is short-run average cost lowest, and how does it compare with long-run average cost at that output?

[2 points] (d) With $\bar{K} = 16$ and a market price of 15, how much does the firm produce in the short run, and what is its profit? Is there a price below which it would shut down?

[2 points] (e) Every firm in the industry has this technology, and in the long run firms can adjust capital and enter or leave freely. What is the long-run equilibrium price, and what happens to profit?

[12 points] 23. Monopoly and price discrimination. A software company is the only seller of a statistics package. It sells licences to two groups that cannot resell to each other: companies, with demand $Q_1 = 90 - P_1$, and students, with demand $Q_2 = 50 - P_2$. The marginal cost of a licence is constant at 10 and there are no fixed costs.

[3 points] (a) If the company must charge everyone the same price, find that price, the number of licences sold to each group and the company's profit.

[3 points] (b) Now the company charges a different price to each group. Find the two prices and quantities and the total profit.

[2 points] (c) Calculate the price elasticity of demand in each market at these prices, and show that the prices satisfy the inverse elasticity rule.

[2 points] (d) Compare total surplus (consumer surplus plus profit) under the single price and under price discrimination. Explain the difference.

[2 points] (e) If the company could perfectly price discriminate, charging each buyer his or her maximum willingness to pay, how many licences would it sell? What would its profit, consumer surplus and the deadweight loss be?

[12 points] 24. Cournot and Bertrand duopoly. Two firms produce an identical product. Market demand is $P = 120 - Q$, where $Q = q_1 + q_2$. Firm 1 has a constant marginal cost of 18 and firm 2 a constant marginal cost of 30; neither has fixed costs.

[3 points] (a) The firms choose quantities simultaneously (Cournot). Write down each firm's profit function and derive both best-response functions.

[3 points] (b) Find the Cournot equilibrium quantities, the market price and each firm's profit.

[3 points] (c) Suppose instead the firms set prices simultaneously (Bertrand), and every buyer purchases from the cheaper firm. Assuming prices can be set in very small steps, find the equilibrium price, the quantities and the profits.

[3 points] (d) Suppose the two firms merge and the merged firm maximises joint profit. Find its output, price and profit, and rank the merger, Cournot and Bertrand outcomes by price and by consumer surplus.

[12 points] 25. Externalities and a Pigouvian tax. A steel mill sells steel in a competitive market at a price of 60 per tonne. Its cost of producing s tonnes is $c(s) = s^2$. Its waste water harms a fishery downstream, raising the fishery's costs by $D(s) = \frac{1}{2}s^2$. There are no other effects.

[2 points] (a) How much steel does the unregulated mill produce? Calculate its profit and the damage to the fishery.

[3 points] (b) Find the socially efficient output, the one that maximises the joint surplus of the mill and the fishery. Explain why the unregulated mill produces too much.

[3 points] (c) What per-tonne (Pigouvian) tax would lead the mill to choose the efficient output? Calculate the tax revenue and the mill's profit after tax.

[2 points] (d) Calculate the deadweight loss of the unregulated outcome.

[2 points] (e) Suppose instead there is no tax, the mill has the legal right to pollute, and the two firms can bargain at no cost. Show that a deal exists that brings output down to the efficient level and makes both firms better off, and give the range of payments that would work.

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