EconS 301- Intermediate Microeconomic Theory
Midterm #2 - Due November 8th at 10.35am, 2022.

1. The market demand function for Pierogi in Pittsburgh Pennsylvania has a constant elasticity of -3. More precisely the actual daily demand was estimated to be $Q = 34560p^{-3}$, where p is the price per pound. Each pound costs $c = \$8$ to produce. Pittsburgh is served by a local monopoly producer. Compute the monopoly's profit-maximizing price and the monopoly's profit level. Show your computations.

2. In Pullman there is only one fortune teller who acts as a monopoly. The inverse demand function for this service is given by $P = 9 - \frac{3Q}{2}$, where P denotes the price charged per visit, and Q the quantity demanded for fortune telling.

   (a) Suppose the cost function of this fortune teller is given by $C(Q) = 3 + Q$. That is, the marginal cost is $c = \$1$ (consisting of her value time and other "communication" expenses), and the fixed cost is $F = \$3$ (say, monthly rent on her office space). Compute and draw the fortune teller's marginal cost and average functions, as well as the marginal revenue function.

   (b) Algebraically compute the fortune teller's profit-maximizing output, price, and profit.

   (c) Compute the price elasticity at the profit-maximizing output.

3. Consider the following simultaneous-move game between the government (row player), which decides whether to offer unemployment benefits, and an unemployed worker (column player), who chooses whether to search for a job. As you interpret from the payoff matrix below, the unemployed worker only finds it optimal to search for a job when she receives no unemployment benefit; while the government only finds it optimal to help the worker when she searches for a job.

		Worker	
		Search	Don't Search
Government	Benefit	3, 2	-1, 3
	No benefit	-1, 1	0, 0

   (a) Represent this game in its extensive form (game tree), where the government acts first and the worker responds without observing whether the government offered unemployment benefits.

   (b) Does government has strictly dominant strategies? How about the worker?

   (c) Find which strategy profile (or profiles) survive the application of IDSDS.

4. The demand function for concert tickets to be played by the Ann Arbor symphony orchestra varies between nonstudents (N) and students (S). Formally, the two demand functions of the two consumer groups are given by $q_N = 7,290(p_N)^{-3}$ and $q_S = 40,960(p_S)^{-4}$. Assume that the orchestra's total cost function is $TC(Q) = 6Q$, where $Q = q_N + q_S$ is to total number of tickets sold. Compute the concert ticket prices set by this monopoly orchestra, and the resulting ticket sales, assuming that the

orchestra can price discriminate between the two consumer groups, say by requiring students to submit their student ID cards. [Hint: $MR = P \times (1 + \frac{1}{\varepsilon})$, where MR denotes marginal revenue and ε is the demand elasticity]

5. Consider a firm with production function $q = \sqrt{z}$, using one input (e.g., labor) to produce units of output q. The price of every unit of input is $w > 0$, and the price of every unit of output is $p > 0$.

   (a) Set up the firm's profit-maximization problem (PMP), and solve for its unconditional factor demand $z(w, p)$.

   (b) What is the output level that arises from using the amount of inputs $z(w, p)$? Label this output level $q(w)$.

   (c) Set up the firm's cost-minimization problem (CMP), and solve for its conditional factor demand $z(w, q)$ for any output level q. (For now, we write the constraint of the CMP to be $f(z) \geq q$, where the output level q that the firm seeks to reach does not necessarily coincide with that found in part (b), $q(w)$.)

   (d) Evaluate the conditional factor demand $z(w, q)$ at output level $q = q(w)$, to obtain $z(w, q(w))$. Show that it coincides with the unconditional factor demand $z(w, p)$ found in part (a), that is,
   $$z(w, q(w)) = z(w, p).$$

6. Some small towns may only have one restaurant, making them a monopoly in that town. Consider Rosie's Diner in a small mountain town. Her inverse demand is $p(q) = 20 - 0.4q$, where q represents meals per week, and her costs are $C(q) = 5q$.

   (a) Find Rosie's profit-maximizing price, quantity, and profits.

   (b) The road into the town has become considerably harder to traverse since a recent mudslide and Rosie's suppliers have increased their delivery price. This has increased her costs to $C(q) = 8q + 10$. How do her equilibrium prices, quantity, and profits change?

   (c) After the mudslide, there have been less visitors hiking the trails around town, which has decreased demand to $p(q) = 15 - 4q$. Does Rosie stay in business?

7. DEFY store provides entertainment to the Moscow community. The demand for stretchy trampoline is $p(q) = 10 - \frac{q}{10}$, and this company's costs are $C(q) = 1 + \frac{q}{2}$.

   (a) Does DEFY exhibit the properties to be a "natural monopoly"?

   (b) Find the unregulated monopolist's profit-maximizing price, output, and profit.

   (c) The Moscow city government passes a law that requires utility and other electricity providers to practice MC pricing (i.e., $p(q^R) = MC(q^R)$). What is the regulated monopolist's output, price, and profit?

   (d) What is the lump-sum subsidy that the regulator must provide the electric utility company to practice MC pricing without operating at a loss?

   (e) Compute the consumer surplus from the pricing strategies in parts (a) and (b).

   (f) Discuss the pros and cons of MC pricing in natural monopolies.