Problem 1. *E-Scooters.* The e-scooter craze is sweeping the nation, with cities like Los Angeles, Chicago, and Atlanta overrun with dockless electric scooters that can be rented via an app. A New Haven startup, Scüt, is hoping to bring the craze to the Elm City. They have determined that their hourly cost function (where quantity is in scooters placed around the city in a given hour of the day) is

$$TC(q) = 40 + q + 0.1q^2$$

Unfortunately for Scüt, the e-scooter business is perfectly competitive, and they may face rivals such as Lime, Bird, and even Uber and Lyft in the future.

(a) What is Scüt's supply function for scooters (for the range of prices where they are willing to supply any), **as a function of the market price *p* (which is hourly revenue per scooter) for an e-scooter**?

Supply function: $Q_S(P) =$_____

(b) If the current prevailing market price (hourly revenue) in the short run is $7 per hour per scooter, how many scooters will Scüt supply, and what will their hourly profit be?

Supplied Quantity: $Q_S(P) =$_____

Hourly Profit (to 2 decimal points): _____

(c) Scüt's success has attracted some attention, leading to a price war in New Haven. In the short-run, the fixed cost component of total costs is unavoidable. What is the price below which Scüt would stop placing scooters around the city in the short term?

*Price*_____

(d) In the long run, there is free entry, and indeed several competitors join the market with the same cost function as Scüt. What will be the long-run equilibrium price (hourly revenue) per e-scooter?

Price _____

Problem 2. Car Pricing

Hyundai is developing an all-new, premium, low-cost electric car to compete with Tesla's Model 3. They plan to market the vehicle in both the US ("U") and Asia ("A"). Demand is estimated to be

$$Q_U = 4{,}000{,}000 - 100P_U$$
$$Q_A = 6{,}000{,}000 - 200P_A$$

They estimate that they will be able to produce the car at a constant marginal cost of $25,000 in either location.

a) First, assume it is very costly to ship cars across the Pacific, and so the company is able to charge different prices in different parts of the world. What is the optimal price, quantity, and profit level in each market?

US Price: _____

US Quantity: _____

US Profit: _____

Asia Price: _____

Asia Quantity: _____

Asia Profit: _____

b) The company is very concerned about its image in the US and is worried about a backlash from consumers if they charge more in one market than another. What is the optimal price, quantity and profit level if they are constrained to charge the same price in both markets? (Note, not all answers will be round numbers – you may round price to the nearest $100 and profit to the nearest $1M).

Global Price: _____

Global Quantity: _____

c) The company has determined that they could pay $100M to make the US version sufficiently different, with an entirely different marketing campaign, such that they could charge different prices in the two different markets. Is this a good idea for the firm to do?

- ☐ Just charge the same price everywhere
- ☐ Charge different prices in Asia and the US, incur $100M cost
- ☐ Not sure / Not enough information.

Problem 3. *FastTEN Your Seatbelts*. The producers of the next "Fast and the Furious" movie are already thinking about how to best monetize the experience. They know that there are two types of fans: "Dominics", who were very eager to see the film, and "Vinces", who were interested but not avid followers of the franchise. The producers did market testing and discovered the following willingness-to-pay for both a regular and premium (3D with souvenirs) theatrical version of the film for each of the two segments. Assume everyone would go just one time. They have also determined that there are **four Vinces for every one Dominic**.

Reservation Prices:	Dominics (1)	Vinces (4)
Regular Film (MC = 0)	25	12
3D Film (MC = 10)	50	20

From the producers' point of view, the marginal cost of the regular format film is zero, while for the 3D version, it is $10 to cover licensing, 3D glasses, and souvenirs.

a. Suppose the producers only wanted to target the "Dominics" fans. What is the optimal price and which version of the film should they release?

- ☐ Release Regular Film
- ☐ Release 3D Film

Optimal Price: _____

b. Now consider that the producers want to charge a price that attracts **both segments**, still only releasing **one version** (Regular or 3D). What is the best price?

☐ Release Regular Film at a price of: _____

OR

☐ Release 3D Film at a price of: _____

c. The producers are now considering offering **both formats** of the film at prices such that fans self-select into the different formats. What prices should they charge to maximize profits under this scheme?

Release Regular Film at a price of: _____

Release 3D Film at a price of: _____

d. Which scheme is the most profitable?

☐ Only release the Regular film ☐ Only release the 3D film

☐ The self-selecting scheme

Problem 4. Market for insurance

Consider the following simple model of health insurance. Let there be three types of people, LOW, MEDIUM, and HIGH risk, whose yearly medical expenses are \$0 with 95% probability and \$25K, \$50K, and \$100K (respectively) with 5% probability for the LOW, MEDIUM and HIGH groups. All three risk types are equally represented in the population, and all people have an initial wealth level of \$100K, and a utility function over wealth of $u(x) = \sqrt{x}$ (where x is measured in thousands of dollars). To be clear, a HIGH risk person therefore has initial wealth of \$100K and a 95% chance of \$0 medical expenses, but a 5% chance of \$100K in medical expenses.

Insurers only offer the simplest policy, where people pay a premium but no deductible and medical expenditure is fully reimbursed. Assume that insurers have no costs other than the expected payouts to their policyholders.

a) Compute the expected cost to the insurer for each type of customer. Also, compute the highest premium that each type of consumer is willing to pay (according to expected utility).
You can simply copy the following table and fill it out.

Customer risk type	Expected cost of customer type to insurer	Highest premium consumer would pay
LOW		
MEDIUM		
HIGH		

b) If it were required that all people be insured, and insurance is competitive so that premiums equal average cost, what would the premium be?

c) If insurance were optional, and again insurance is competitive so that premiums equal average cost, what premium would insurers charge? And which risk types would choose to buy insurance at that premium? (Hint: Note that they would consider charging one of the values solved for in part a).