Show all work. Write legibly.

Calculators permitted.

No computers.

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<th>Points:</th>
<th>Possible</th>
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1. (Total 33 points) Pricing Vaccines
Consider the following hypothetical scenario about a new vaccine. Research indicates that the likelihood of getting thyroid cancer in a lifetime is around 1.3%. Thyroid cancer can occur in any age group, although it is most common after age 30, and its aggressiveness increases significantly in older patients. Abbott Laboratories has gone successfully through the Phase III trials for their new (first ever) vaccine to prevent thyroid cancer which is now approved by the FDA. To be effective, the vaccine has to be administered before any of the cancer cells start developing. Clinical trial documents and general health research indicate that:

- The new vaccine is 60% effective
- Life expectancy with thyroid cancer is 63 years
- Life expectancy without thyroid cancer 78 years
- For simplicity assume that Quality Adjusted Life Year (QALY) per year with and without thyroid cancer is the same and is equal to 1.0 for individuals under 70 years and equal to 0.8 if they are 70 or older.
- Abbott Laboratories intends to set the price of the new vaccine at $1000.

a) (15 points) Assuming there are no other costs associated with administering the vaccine and no costs associated with treating thyroid cancer, calculate the cost per QALY. Show all work.
b) (6 points) Suppose that vaccine prices are set so that the cost of QALY comes out to $30,000. What is the price that corresponds to this level of cost of QALY?

c) (6 points) Briefly describe one way to calculate the value of statistical life (VSL). You can either describe it in words or write out a formula with the parameters appropriately defined.

d) (6 points) A lot of people may argue that such calculations (VSL, QALY) are controversial and unethical because they put a “dollar sign” on human health or life. Provide at least one justification for these measurements.
2. **(Total 18 points) Hotel room pricing with capacity constraints**

Trump international Hotel in Chicago has 279 rooms. Trump International offers a discount fare of $199 targeting leisure travelers. The regular fare is $299 and targets business travelers. There is no shortage of demand for low fare rooms. However, the demand for high fare rooms is uncertain. From previous experience and hotel occupancy data, you have estimated that the business traveler demand follows a normal distribution with mean=53 and standard deviation=14.

*Note: the problem set-up above might have more information than you will need to use in your calculations, you need to figure out which pieces of information are relevant to answer each question.*

a) **(5 points)** What are the underage and overage costs in this example? What critical ratio would you use to find the optimal protection level?

b) **(5 points)** Suppose that Trump International allows overbooking and it estimates that the loss of monetary and nonmonetary goodwill for each bumped customer will be around $300. What are the underage and overage costs in this example? What critical ratio would you use to find the optimal level of overbooking?
c) **(4 points)** As the difference between the low and high prices increases, the number of rooms reserved for business travelers ________________ (increases or decreases). Briefly explain the intuition behind such relationship.

d) **(4 points)** As the standard deviation of expected demand increases, the number of rooms reserved for business travelers ________________ (increases or decreases). Briefly explain the intuition behind such relationship.

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3. **(Total 16 points) Miscellaneous topics**
   a) **(8 points)** What is tacit collusion? Give at least one example of a business practice that facilitates tacit collusion.
b) **(8 points)** Illustrate two-part tariff on a graph: Draw a downward sloping demand curve and a constant marginal cost curve. Mark the appropriate lines and areas that represent the two-part tariff. Explain how it is calculated or provide a formula that includes parameters marked on your graph.

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4. **(Total 21 points) Information goods**

a) **(6 points)** Draw the Average Fixed Cost (AFC) and Average Total Cost (ATC) curves for (i) a typical, non-digital product facing scarcity of resources and (ii) a digital product (2 graphs with 2 curves on each graph).

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b) **(5 points)** What types of market structures do we usually see in these information markets? Briefly explain how each mentioned market structure is related to the cost structure of information products.
c) **(3 points)** List 3 excludability strategies that are or have been used in the past by companies selling information goods.

d) **(7 points)** Your Aunt Anne has heard that “network externalities” is an important concept that explains why some companies achieve large shares of the markets that they enter. Explain to Aunt Anne what the concept means and whether network externalities can be an explanation for large market shares. Give an example of a product where network externality was/is important.
You are the head of the marketing division of SKIN BEAUTY, Inc. the sole producer of a facial oil skin-life extender. You need to determine the advertising budget for next year. The marketing department has provided you with three important items of information: (a) The company hopes to achieve $10 million sales next year; (b) it is estimated that a 1% increase in the advertising budget would increase quantity sold by 0.05%; (c) it is estimated that a 1% increase in the product’s price would reduce quantity sold by 0.2%. According to the Dorfman-Steiner rule, how much money should you allocate for advertising next year?
Extra sheet for calculation