Answer all questions. If you don’t explain (= show your work for) your answers you will get no credit.

NAME: ______________________________ University ID: _______________________

- By writing your name on this exam you certify that you have not violated the University’s Code of Academic Contact (for example, you have not copied from the work of another student and you have not knowingly facilitated cheating by another student).

- If you submit the exam without writing your name and ID, you will get a score of 0 for this exam.

- If you do not stop writing when told so (at the end), a penalty of 10 points will be deducted from your score.
If you use this page to continue the answer(s) to some of the questions below, you need to:
1. Clearly write in the space provided under the question that the answer continues on page 2,
2. Clearly write on this page to which question(s) you are providing the continuation of your answer.
1. [10 points] Consider the market for second-hand electric bicycles. The possible quality levels, proportions and values to seller and buyer are given in the following table:

<table>
<thead>
<tr>
<th>Quality:</th>
<th>L</th>
<th>M</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>proportion</td>
<td>1/12</td>
<td>3/4</td>
<td>1/6</td>
</tr>
<tr>
<td>value to seller</td>
<td>$1,500</td>
<td>$2,000</td>
<td>$2,100</td>
</tr>
<tr>
<td>value to buyer</td>
<td>$1,600</td>
<td>$2,150</td>
<td>$2,300</td>
</tr>
</tbody>
</table>

As usual, information about quality is asymmetric: the seller knows the quality of his own electric bicycle, while potential buyers cannot tell. Buyers are risk neutral. The data in the above table is common knowledge among all the people involved.

(a) [5 points] Suppose that the price of a second-hand electric bicycle is $2,115. Are any second-hand electric bicycles traded in the second-hand market? If your answer is Yes, explain why and state which qualities are traded. If your answer is No explain why.

(b) [5 points] Suppose that the price of a second-hand electric bicycle is $2,020. Are any second-hand electric bicycles traded in the second-hand market? If your answer is Yes, explain why and state which qualities are traded. If your answer is No explain why.
2. [30 points] There are two types of individuals. They have identical initial wealth of \( w = \$6,400 \), they face a potential loss of \( x = \$2,800 \) and they have a utility-of-money function \( U(m) = \sqrt{m} \). For individuals of type \( H \) the probability of loss is \( p_H = \frac{1}{4} \) while for individuals of type \( L \) the probability of loss is \( p_L = \frac{1}{5} \). The number of \( H \) types is \( N_H = 400 \) and the number \( L \) types is \( N_L = 3,000 \). The insurance market is a monopoly. The monopolist knows all of the above data but cannot tell whether any particular customer is of type \( H \) or type \( L \). The monopolist is considering several options (refer to the following figure). Assume that (1) if indifferent between insuring and not insuring, a consumer would choose to insure and (2) if indifferent between two contracts, then the consumer would choose the one with lower deductible.

(a)[3 points] Calculate the expected utility of an \( H \) type if she does not insure.

(b)[3 points] Calculate the expected utility of an \( L \) type if she does not insure.

(c)[5 points] Suppose that the monopolist offers only contract \( A \). What is the monopolist’s total profit?
(d) [7 points] Suppose that the monopolist offers only contract B. What is the monopolist’s total profit?

(e) [8 points] The premium of contract D is $500. Write a system of two equations whose solution gives the premium and the deductible of contract C.

(f) Suppose that the monopolist offers contracts C and D and lets consumers choose.
   (f.1) [2 points] Which contract will the H types choose?
   (f.2) [2 points] Which contract will the L types choose?
3. [30 points] Susan has an initial wealth of $2,304 and faces a potential loss of $704 with probability $\frac{1}{4}$. Her utility-of-wealth function is $U(m) = 100 \ln(m)$ (where $\ln$ is the natural logarithm, that is, the logarithm to the base $e$).

(a) [5 points] Calculate the slope of her indifference curve that goes through NI (the No Insurance point) at that point (in the usual wealth diagram).

(b) [4 points] Calculate the risk premium associated with the NI lottery.

There is only one firm offering insurance; the firm lets the customer choose the deductible $D$ and the corresponding premium is then given by $h = 192 - \frac{D}{4}$.

(c) [4 points] If Susan chooses a contract with $D = 360$, what is the expected profit from this contract for the insurance company?

(d) [4 points] If Susan chooses a contract with $D = 360$, what is her expected utility?

(e) [4 points] If Susan chooses to fully insure, what is the expected profit from this insurance contract for the insurance company?

(f) [4 points] If Susan chooses to fully insure, what is her expected utility?

(g) [5 points] Write an equation of the form $W_2 = a - bW_1$ that corresponds to $h = 192 - \frac{D}{4}$ (where, as usual, $W_1$ is wealth in the bad state).
4. [30 points] The owner of a firm (the Principal) wants to hire a manager (the Agent) to run the firm. There are two possible outcomes, measured in terms of the profits of the firm: \( \pi_1 = $6,000 \) and \( \pi_2 = $4,000 \). The probability of outcome \( \pi_1 \) is 20% and the probability of outcome \( \pi_2 \) is 80%. A contract is a pair \((w_1, w_2)\), where \( w_1 \) is the payment to the Agent if the profit turns out to be \( \pi_1 \) and \( w_2 \) is the payment to the Agent if the profit turns out to be \( \pi_2 \) (thus net profits are \( \pi_1 - w_1 \) and \( \pi_2 - w_2 \), respectively). Consider the following contracts: \( A = (3,200, 1,600) \), \( B = (3,500, 1,500) \) and \( C = (2,000, 2,000) \). The Edgeworth boxes that you draw should be such that the long side is the horizontal side and the origin for the Principal is in the bottom-left corner.

(a) [9 points] In an Edgeworth box draw the 45° lines and represent the three contracts \( A, B \) and \( C \).

(b) Assuming that the **Principal is risk averse and the Agent is risk neutral**, (b.1) [8 points] Sketch (in the above Edgeworth box) the indifference curves through contracts \( B \) and \( C \). Clearly indicate the person to whom each indifference curve refers and the shape of each curve.
(b.2) [4 points] Of the three contracts, which (if any) are Pareto efficient?

(b.3) [4 points] How does the Agent rank the three contracts?

(b.4) [5 points] If the Principal’s utility-of-money function is \( U(m) = \sqrt{m} \), how does she rank the three contracts?