

WINTER 2024 - FIRST MIDTERM EXAM **Version 1**

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.**

1. [55 points] Jim has an initial wealth of \$120,000 and faces the possibility of a loss in the amount of \$40,000. Let p be the probability of loss.

(a) Each of the following contracts is given in terms of two numbers (h, d) , where h is the premium and d is the deductible: $A = (7,000, 20,000)$, $B = (8,200, 15,000)$, $C = (6,000, 35,000)$. Re-write them in terms of (W_1, W_2) , where W_1 is wealth in the bad state and W_2 is wealth in the good state.

(a.1) [4 points] $A =$

(a.2) [4 points] $B =$

(a.3) [4 points] $C =$

(b) (b.1) [6 points] For what value of p do contracts A and B lie on the same isoprofit line?

(b.2) [6 points] What is the slope of an isoprofit line in the (W_1, W_2) plane for the value of p found in Part (b.1)?

(c) [8 points] For the value of p found in Part (b), does contract C lie on a higher or lower isoprofit line in the (W_1, W_2) plane relative to the isoprofit line that goes through contract B ?
[No credit if you don't show your work.]

(d) [4 points] For a general value of p , what is the premium of the full-insurance contract that lies on the zero-profit line?

(e) Suppose that Jim's utility-of-wealth function is $U(w) = \sqrt{w}$ and that the probability of loss is 30%.

(e.1) [12 points] How does Jim rank the three contracts A, B and C?

(e.2) [7 points] If the choice was between contract C and no insurance, what would Jim choose?

2. [45 points] Gwen, who obeys the axioms of expected utility theory, is faced with four possible basic outcomes: A , B , C and D . Her ranking of these outcomes is $A \succ B \succ C \succ D$. Gwen is indifferent between the certainty of B and a lottery where there is a 25% probability of A and a 75% probability of D . She is also indifferent between the certainty of C and a lottery where there is a 20% probability of B and a 80% probability of D .

(a) [12 points] Construct a von Neumann-Morgenstern utility function that reflects these preferences and is such that the largest utility is 80 and the smallest utility is 20.

(b) [10 points] How does Gwen rank the lotteries $L = \begin{pmatrix} A & C & D \\ \frac{1}{10} & \frac{2}{5} & \frac{1}{2} \end{pmatrix}$ and $M = \begin{pmatrix} B & C \\ \frac{2}{5} & \frac{3}{5} \end{pmatrix}$?

(c) [10 points] For what value of p is Gwen indifferent between

$$L = \begin{pmatrix} A & C & D \\ \frac{1}{10} & \frac{2}{5} & \frac{1}{2} \end{pmatrix} \text{ and } N = \begin{pmatrix} B & C \\ p & 1-p \end{pmatrix}?$$

(d) [13 points] Normalize the utility function of Part (a)