University of California, Davis -- Department of Economics

ECN 103 : ECONOMICS of UNCERTAINTY Professor Giacomo Bonanno

WINTER 2024 - FIRST MIDTERM EXAM Version 2

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 \$80,000 and faces the possibility of a loss in the amount of \$25,000. 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: $A=(6,000\ ,15,000)$, $B=(7,200\ ,12,000)$, $C=(5,000\ ,18,000)$. 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 Pat (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 60%.
(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 $D \succ B \succ C \succ A$. Gwen is indifferent between the certainty of *B* and a lottery where there is a 20% probability of *A* and a 80% probability of *D*. She is also indifferent between the certainty of *C* and a lottery where there is a 25% probability of *B* and a 75% probability of ~~*D*~~ A.

(a) [12 points] Construct a von Neumann-Morgenstern utility function that reflects these preferences and is such that the largest utility is 60 and the smallest utility is 10.

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

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