

1. A lottery costing \$1 is created based on a random drawing of a number between 1 and 20,000,000. If the player guesses the number, they win \$15,000,000. Suppose a person is risk neutral, i.e., their utility is linear in income ( $U(X) = X$ ). Will this person ever play the lottery? Why would anyone ever play such a game?
2. Suppose that a utility function is  $U(X) = \sqrt{X}$  where X is measured in thousands of dollars. Franklin's current job pays \$2,500 per month with certainty. Franklin can choose to work for himself and have a 50% chance of earning \$3,600 per month and a 50% chance of earning only \$1,600. Should Franklin take the new job? Does your answer change if Franklin's utility function is  $U(X) = \ln(X)$ ?
3. Suppose that everyone has the same utility function and an annual income but people face different risks to health. Person A has a 10% chance of experiencing a health shock that requires \$1000 in expenses while Person B has a 0.1% chance of experiencing a health shock that requires \$100,000. Calculate the expected loss of the two individuals. Which individual will be willing to pay more for insurance? Explain your answer.
4. Otto has a job where he earns \$50,000 per year but there is a probability 2% Otto will be injured on his job. If injured, Otto will not be able to work and his income will fall to zero. Otto's utility function is  $U(x) = 2\sqrt{x}$ .
  - a) What is Otto's expected earnings? What is his expected utility? What is the certainty equivalent? What is his risk premium?
  - b) If Otto's employer gave him worker's compensation which paid him half of his salary in the case of injury, what is his new expected earnings? What is his new expected utility? What is the new certainty equivalent? What is his new risk premium? If the worker's compensation is through a third-party insurer, what is the insurance company's profit? What is the ratio of profit to capital if the insurance company must keep 10% of capital on hand?
  - c) and d) Do parts a) and b) but now assume his utility function is  $U(x) = \ln(X)$ .