

**Quiz 2**

## answers

**Instructions:** You have 50 minutes to complete this exam. For the short-answer questions, please support your answers by showing your work and writing out complete explanations for any claims you make. Good luck!

**Problem 1 (5 points)** By next year, a stock you own has a 25% probability of being worth \$400, and a 75% chance of being worth \$200. What is the variance of its price?

- a. 5,000
- b. 7,500
- c. 10,000
- d. 12,500
- e. 15,000

**Problem 2 (5 points)** Elroya makes \$100,000 of certain income at her current job. Suppose she is offered a job that pays her \$200,000 with probability .25 and \$60,000 with probability .75. Which of the following statements is true?

- a. She will take the new job if she is risk neutral.
- b. She may or may not take the new job if she is risk neutral.
- c. She will take the new job if she is risk averse.
- d. She may or may not take the new job if she is risk averse.

There is a problem with this question (none of the answers are correct). Everyone will get 5 points for this question.

**Problem 3 (10 points)** Greg is a day trader, while his neighbor Jennifer is a professor. Greg's income is risky; if he has good luck (probability .5), he makes \$160,000/year. If he has bad luck (probability .5), he makes only \$40,000. Jennifer's job is more stable. She makes \$100,000/year with certainty. Both receive utility  $\sqrt{w}$  from wealth  $w$ .

Would Greg trade jobs with Jennifer if he were given the option? If so, give the maximum amount by which Jennifer's income could be lowered for which this is still true. If not, give the minimum amount by which it would have to be raised before he would choose to switch.

Greg would get utility  $\sqrt{100,000} = 316.23$  from Jennifer's job. From his job, he gets utility  $.5\sqrt{40000} + .5\sqrt{160000} = 300$ . Clearly, then, he would prefer to switch jobs, at least thinking about income alone. This would still be true so long as the professor job pays at least  $\$X$ , where  $X$  is given by  $\sqrt{X} = 300$ , or  $X = 90,000$ . Thus, Jennifer's income could be lowered by up to \$10,000 before Greg would prefer to keep his own job.

**Problem 4 (10 points)** Suppose that two investments have the same three payoffs, but the probabilities associated with each payoff differs, as follows:

payoff	Probability (investment A)	Probability (investment B)
\$300	.10	.30
\$250	.80	.40
\$200	.10	.30

- a. Find the expected return and standard deviation of each investment.

The expected return of investment A is  $.1 * \$300 + .8 * \$250 + .1 * \$200 = \$250$ . The variance is given by  $.1 * (300 - 250)^2 + .8 * (250 - 250)^2 + .1 * (200 - 250)^2 = 500$ , so the standard deviation is  $\sqrt{500} = 22.36$ . Via similar calculations, the expected value of investment B is \$250, while the standard deviation is 38.72.

- b. Jill has the utility function  $u(w) = 5w$ , where  $w$  is the investment's payoff (assume she has initial wealth 0). Which investment does she prefer?

Jill is risk neutral. As the two investments have the same expected payoff, she will be indifferent between investment A and investment B.

- c. Ken has the utility function  $u(w) = 5\sqrt{w}$  (assume he has initial wealth 0). Which investment will he choose?

Ken is risk averse. Since the two investments have the same expected return, he will choose the one with the lower risk, which is investment A (this can also be computed directly from calculating his expected utility from each investment).

**Problem 5 (10 points)** Answer the following two questions about insurance markets:

- a. Explain the concept of adverse selection as it relates to insurance markets in 2 sentences or less.

Answers will vary. Basically, adverse selection in an insurance market means that the people most likely to buy insurance are those most likely to use it (example: in a system where everyone must decide whether or not to purchase their own health insurance, the sickest people will buy health insurance and the healthiest will not).

- a. Explain the concept of moral hazard as it relates to insurance markets in 2 sentences or less.

Basically, moral hazard in an insurance market occurs when an insured party is more likely to take risks knowing that the costs of a claim will be borne by the insurance company, and not the insured (example: someone who purchases rental car insurance drives more recklessly than he would in his own car).

**Problem 6 (10 points)** Suppose a risk-averse individual currently has a job that pays \$100 of certain income every day. She is considering a sales job at another company where each day's wage is uncertain: she makes  $\$100 - x$  with 50% probability and  $\$100 + x$  with 50% probability, where  $x$  is some number between 0 and 100. Her utility function over daily earnings is  $u(w) = \sqrt{w}$ , where  $w$  is the dollar amount of her earnings each day.

- a. Will she prefer her current job or the new, sales job, or is there not enough information to tell? Explain your answer.

She will certainly prefer her current job. This is because it has the same expected salary as the sales job, but less risk.

**b.** Use either a graph or math to show that the risk premium she would pay to avoid taking the sales job is increasing in  $x$ .

This is easiest to see with a simple graph (see figure on next page). Expected salary is \$100, and risk premium is the difference between expected salary and certainty equivalent. Consider two values of  $x$ , one small ( $x_1$ ) and one large ( $x_2$ ). Given a concave utility function, expected utility and therefore certainty equivalent will be lower with  $x_2$ , and so risk premium will be larger in this case.

