

Name: \_\_\_\_\_ ID: \_\_\_\_\_

1. Multiple choices. (select only ONE option.) [10' total, 2' each]
- a) According to the Rothschild-Stiglitz Model, which one of the following statement is INCORRECT?
- A. In the private insurance market, only the frail type customers are fully insured, and the robust type is underinsured.
  - B. The adverse selection issue is substantial in the private insurance market.
  - C. A pooling equilibrium cannot exist.
  - D. A separating equilibrium always exists.
- b) Public good is the type of goods that:
- A. Nonrival in consumption
  - B. Public good is under-provided privately and leads to welfare loss.
  - C. Patent is one of the solution to ensure provision of public goods.
  - D. All of them are correct.
- c) Which one of the following statement is CORRECT about moral hazard?
- A. Using expensive drugs instead of generics is the typical *ex ante* moral hazard.
  - B. With moral hazard, the higher the price sensitivity of the demand is, the greater the social loss is.
  - C. A universal public insurance can mitigate the moral hazard comparing to a private market.
  - D. None of those are correct.
- d) We discussed the market for lemons using the example of the used car market. When can this type of market for lemons work?
- A. If buyers value the cars very highly.
  - B. If there is a minimum guaranteed quality.
  - C. Both.
  - D. Neither.
- e) Which one of the following statement is INCORRECT about international comparisons?
- A. US has the highest health care expenditure while the health outcomes are relatively low comparing to OECD average.
  - B. The life expectancy increases as a society becomes more developed and over time.
  - C. According to OECD 2010, US have higher utilization and resources than the OECD average.
  - D. There is a positive correlation between health expenditure and GDP per capita for most of the societies.

2. Demand of health care. [15']

Consider the following table from the RAND HIE study.

Plan	Outpatient Care Avg # of annual visits	Emergency Care Avg # of annual visits
Free	2.99	0.15
25%	2.32	0.12
95%	1.90	0.10

- a) What can we know about the slope of demand of health cares from this table? [5']
- b) Calculate the arc price elasticity of demand for outpatient care in moving from the 25% plan to the free plan. [5'] (For simplicity, assume that the rate for each plan is the effective rate.)
- c) Without further calculation, which demand of these two cares should be more price-sensitive? Explain. [5']

3. Health Technology Assessment. [15']

a) Consider the cost-effectiveness of intensive care unit (ICU) treatment of patients suffering from cardiac issues who were admitted in a specific hospital. We assume that all would have died if not admitted to hospital. The total hospital costs for all those admitted summed to \$30,000,000. It was estimated that a total of 2,400 life years were saved and government views a quality-adjusted life years (QALY) as being worth \$60,000.

i) Suppose that each of these saved years of life receives a quality weight  $q=0.75$ . Calculate the total QALY saved by this program. [5']

ii) Calculate the average cost-effectiveness ratio and compare it to the government's evaluation of a QALY. Is the program worthwhile? [5']

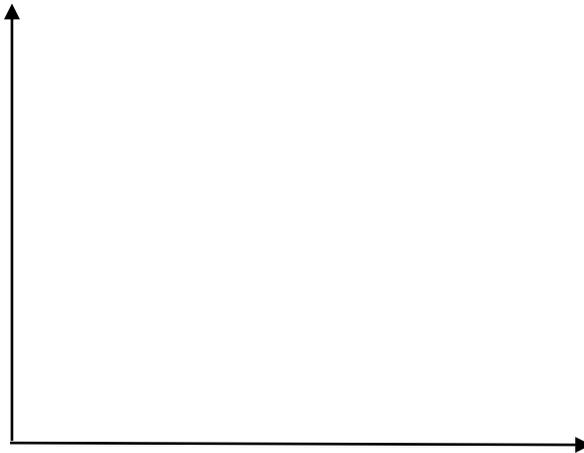
b) The following table comes from the Sixth Stool Guaiac screening program, which conducts a sequence of six tests for early detection of colon cancer. What fundamental thing do we learn from this table? Explain. [5']

<u>Up to Six Tests</u>			
Number of Tests	Cases Detected	Marginal Cost	Marginal Benefit
0	0	-	-
1	648	\$2,464,800	\$64,800,000
2	712.8	\$1,706,500	\$6,480,000
3	719.28	\$1,380,600	\$648,000
4	719.928	\$1,124,100	\$64,800
5	719.9928	\$919,200	\$6,480
6	719.99928	\$755,400	\$648

4. Suppose that there are three types of drugs that can be used to treat the same disease. Their cost and effectiveness (measured by life year) are listed in the table below. [20']

Drug	Cost	Life year
A	\$40	1
B	\$80	0.2
C	\$160	3
D	\$360	3.4

- a) For an uninsured individual, plot these four drugs in the following diagram and draw the cost-effectiveness frontier. [5']



- b) Calculate the incremental cost-effectiveness ratio (ICER) of drug B over drug A. What does the result tell us? [5']
- c) Now consider that this individual has an insurance that covers 90% of the drug costs. With the insurance, what is the out-of-pocket price of drug A? Draw the cost-effectiveness frontier with insurance on the diagram in part (a). (Note: You don't need to be very precise for the scale on axis, but you need to label the corresponding numbers.) [5']
- d) Explain the role of moral hazard in health care overuse. You can use the example from part (a) and (c). [5']

5. Demand for health insurance. [10']
- a) Give the actuarially fair premium for someone who faces loss of \$100 with probability of 0.05 and loss of \$ 1,000 with probability 0.95. [3']
- b) Company A sells insurance to 100 individuals with expected loss of \$5,000 and standard deviation of \$1,000. Company B sells insurance to 10,000 individuals with expected loss of \$5,000 and standard deviation of \$5,000. Which insurance company is exposed to greater risk per insured person? Explain. (**Hint:** use the standard deviation of the mean  $SD(\bar{X})$ ). [3']
- c) On an appropriate diagram, show the expected utility level for a risk-averse person facing income of either \$20,000 or \$100,000 with equal probability. **Note:** Calculate the expected income. [3']
- d) On the same diagram, show the level of certain income that gives the same level of utility as the expected utility in part (c). [1']

6. Suppose, for simplicity, that a doctor trains for 1 year, becomes a resident for 1 year and works 1 year. You are given the following data for a doctor and for a typical college graduate who begins work immediately after college over three years. The discount rate is 20%. [10']

Year	1	2	3
Doctor	-40	60	144
College Graduate	30	48	72

- a) Calculate the net present value (NPV) for both career options. [4']
- b) Write down the formula to calculate the internal rate of return (IRR). (You don't need to calculate the number for IRR, but explicitly show the equation that can be used for the calculation.) [3']
- c) Given your answer to part (a), would you expect the IRR to be greater, smaller, or equal to the discount rate 20%? [3']

7. Externality. [20']

Consider vaccination against a contagious disease. If a person is vaccinated there is a direct benefit to the person (they are less likely to get the disease), as well as an indirect benefit to others (someone vaccinated is less likely to pass the disease to others).

The private demand of vaccination is:  $Q=100-P$ . The indirect benefit (externality) to others is worth \$10 per vaccination. Each vaccination costs \$50.

a) Show on an appropriate diagram that a competitive market will lead to too few people having vaccinations. [5']

b) On the same diagram show the social loss to society due to the externality. State how you identify this social loss. [5']

c) Calculate the privately optimal and socially optimal consumption of vaccinations. [6']

d) Suppose the government decides to pursue a Pigouvian solution to eliminate social loss. What sort of tax/subsidy would they implement? What is the resulting consumption of vaccinations? [2']

e) What are the two main assumptions for the Coase Theorem? [2']