UNIVERSITY COLLEGE LONDON

EXAMINATION FOR INTERNAL STUDENTS

MODULE CODE	:	**ECON3016**
ASSESSMENT PATTERN	:	**ECON3016A**
MODULE NAME	:	**Economics of Information**
DATE	:	**06 May 2016**
TIME	:	**10:00 am**
TIME ALLOWED	:	**2 hours**

This paper is suitable for candidates who attended classes for this module in the following academic year(s):

2015/16

TURN OVER

SUMMER TERM 2016

ECON3016: ECONOMICS OF INFORMATION
Exam Paper

TIME ALLOWANCE: 2 hours

Answer ALL questions from Part A and Answer ONE question from Part B.

Questions in Part A carry 50 *per cent of the total mark and questions in Part B carry* 50 *per cent of the total mark each.*

In cases where a student answers more questions than requested by the examination rubric, the policy of the Economics Department is that the student's first set of answers up to the required number will be the ones that count (not the best answers). All remaining answers will be ignored.

PART A

Answer all questions from this part.

A.1 (50% of the mark for part A.) Consider a market for used cars where each seller owns a single car of quality $q \in \{0, 1\}$. A car of quality q works without problems with probability $\frac{2}{3} + \frac{q}{3}$, and breaks down with probability $\frac{1}{3} - \frac{q}{3}$. The utility of a seller, when selling a car of quality q for price p is $p - \frac{7}{8}q$. For a buyer who pays p, the utility of driving a car if it does not break down is $1 - p$, and $-p$ if it does break down. If the buyer does not own a car her utility is zero. Buyers are risk-neutral. Assume that there are as many buyers as sellers and each buyer is interested in buying at most one car.

Suppose that half of the sellers have a car of quality zero and half of them have a car of quality one. The quality of a car is observable for its owner (the seller) but not for a buyer.

(a) Describe verbally what type of asymmetric information you find in this situation? (In 2-3 sentences.)

(b) Which qualities are traded in an efficient allocation? Explain your answer.

(c) Derive the maximal price a buyer is willing to pay if she buys a car from a random seller and denote it p^{max}. (You must get $p^{max} < \frac{7}{8}$ which you may use below.)

(d) Argue that $p = \frac{5}{6}$ is not an equilibrium price under asymmetric information.

(e) Derive the equilibrium price in this market under asymmetric information and show why other prices than the one you find cannot be equilibrium prices. Is the market outcome efficient?

A.2 (50% of the mark for part A) Consider a company that has production facilities in an area that is prone to occasional flooding. Given that there were 10 floods in the last 100 years, the probability of a flood is estimated to be $p_F = 10\%$. The value of the company is $y_0 > 0$, half of which is the value of the production facilities. After a flood, the facilities have to be rebuilt completely at a cost of $\frac{y_0}{2}$. The company can obtain full or partial flood insurance. To ensure an amount x, the company has to pay a premium ax. The insured amount cannot be higher than the cost of rebuilding the production facilities. Assume that the company maximizes the expected utility of its owner which depends only on the final value of the company.

(a) Write down the lottery that the company faces if it decides to insure an amount x and leave the rest uninsured.

(b) How does the insured amount x depend on a if the company's owner is risk neutral?

(c) Suppose a is sufficiently large so that the risk-neutral owner would choose $x = 0$. Describe verbally, the trade-off faced if the owner is risk-averse and compare this to the risk-neutral situation.

(d) Suppose that the Bernoulli utility function of the owner is $U(y) = \log y$, where y is the final value of the company.[1] Show that for this utility function, the company will buy partial insurance if $a = 15\%$.

[1] $\log x$ denotes the natural logarithm.

PART B

Answer one question from this part, either B.1 or B.2.

B.1 Consider a company that employs workers to assemble bicycles. Bicycles may have defects that lead to complaints and refunds by customers. Defects can arise either because of faulty bicycle parts, or because workers are careless. The company knows that on average 5% of the bicycle parts it receives from suppliers lead to defects. If a worker works carefully, she will not produce any defects in addition to those caused by faulty parts. If she does not work carefully, she increases the share of defective bikes to 10%. The company cannot observe whether a worker is careful or careless and cannot determine which worker assembled a defective bike if it is returned by a customer.

Suppose that the company can introduce quality check at a cost of $c > 0$ per bike. With quality checks, half of the defects are verifiably detected before shipping bikes to customers. It cannot be verified whether a defect is due to faulty parts or careless work but the company can identify the worker who assembled a bike if the defect is found in the quality check.

The average profit per bike depends on the wage per bike paid to the worker w, the rate of defects, and whether defects are found by quality checks or by the customers (in this table, averages are taken over bikes with defects and no defects):

rate of defects	with quality check	without quality check
10%	$20 - c - w$	$15 - w$
5%	$25 - c - w$	$20 - w$

The company is risk neutral and makes a contract offer to each worker that the worker can either accept or reject. A worker's Bernoulli utility per bike is given by $U(w) - v$, $v > 0$, when working carefully, and by $U(w)$ per bike when working carelessly. Assume that $U'(w) > 0$ and $U''(w) < 0$. A worker who does not work for the company has a utility equal to $\underline{U} = 0$.

(a) Describe verbally what type of asymmetric information you find in this situation.

(b) Suppose first that quality checks are not possible. The company offers a wage per assembled bike. What is the optimal contract in this situation? What will be the resulting rate of defects if this contract is used?

(c) Now suppose that quality checks are available. Determine the optimal contract if $v = 1$, $c = 1$, and $U(w) = \log w$. Is it optimal to use quality checks? What will be the resulting rate of defects?
When solving the problem, state the relevant optimization problem(s), describe the role of the constraints you use, and use your knowledge from the lecture to derive the optimal contract.

(d) The company learns about modern computer technology that can be used to verify which worker assembled a bike if a customer finds a defect. Assume that customers will always make a complaint if a bike has a defect. Introducing the technology would cost $C = c$ per assembled bike (both with and without defect). The profits defined above are unchanged except for the additional cost of the new technology.
Compare the optimal contract if only the quality check is available to the one where in addition also the new technology is available. Discuss intuitively, what are the advantages and disadvantages of using each technology.

(e) What does the optimal contract look like if the company can instead use a technology that also allows it to verify whether the defect in a bike returned by a customer is caused by faulty parts or careless work?

B.2 Consider a market for health insurance in which risk-neutral insurance companies compete for customers. Assume that each consumer has an income of y_0 (which may be different across customers). If a customer is healthy, her (Bernoulli) utility is equal to $U(y_0 - x_h)$ where x_h is the sum of all payments she makes (or receives if $x_h < 0$). If she is ill, her utility is $U(y_0 - s - x_{ill})$, where $s > 0$ is the monetary compensation required to compensate her for suffering from the illness and to cover all costs of healthcare. x_{ill} is the sum of all payments when ill. Assume that $U(y) = -e^{-y}$. The probability of falling ill can be either low p^L or high $p^H > p^L$ and is only known to the customer. Insurance companies offer insurance contracts (P, I) that consist of a premium P and an indemnity I.

(a) What kind of asymmetric information do you find in this market?

(b) Describe the lottery over final income that is implied by an insurance contract (P, I).

(c) Argue that for the given utility function, the optimal choice of insurance contracts for a consumer is independent of her income y_0. (You may use this result in the following sub questions even if you cannot answer this.)

(d) Define the concept of a separating equilibrium for this market.

(e) Assume that a separating equilibrium exists and derive the contracts used in the equilibrium. Derive explicit expressions for P^H and I^H, also derive P^I as a function I^L and an equation that determines I^L. (Use your knowledge about the separating equilibrium from the lecture.)

(f) Suppose the government intervenes in this market for health insurance and requires everyone to have the same level of coverage. What level of coverage is optimal? Discuss possible reasons why the nature of the optimal contract should change in a more realistic model of the health insurance market.