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Economics of Information

2. Exam Winter Term 2013/14

Important Instructions

1. There are 90 points on this 90 minutes exam.
2. You can answer the questions either in English or in German.
3. You are allowed to use a non-programmable calculator.
4. You are not allowed to use any course material (books, slides, lecture notes etc.).
5. Please answer the questions only on the paper that is handed out to you.
6. Please write your name on each sheet of paper, number the pages and leave a margin (2.5cm) on the right of each page.
7. Please write legibly and make sure that your answers are coherent and complete.

Good Luck!

Problem 1 (45 Points)

A firm contracts with an engineer to develop a new product. The engineer can choose between two effort levels $e \in \{0, 1\}$. There is either a high or a low demand for the new product which partly depends on the engineer's effort to develop a fancy product. If effort is low ($e = 0$), demand is high with probability $\frac{1}{4}$ and low with probability $\frac{3}{4}$. If effort is high ($e = 1$), demand is high with probability $\frac{1}{2}$ and low with probability $\frac{1}{2}$.

If demand is high, the firm's revenue from selling the new product is $x_H = 1000$, if demand is low, the firm's revenue is $x_L = 600$. The engineer has an expected utility function with von Neumann-Morgenstern utility function $U(w, e)$ which depends on the wage w the firm pays to the engineer and on his effort level e. $U(w, e)$ is given by

$$U(w, e) = u(w) - v(e),$$

where

$$\begin{aligned} u(w) &= \ln(w) \quad \text{for } w > 0, \\ \text{and} \quad v(e) &= e \qquad \text{for } e = 0, 1. \end{aligned}$$

The engineer's reservation utility is

$$\underline{U} = 0.$$

The firm is risk neutral and wants to maximize its expected profit.

When answering the following questions you can use all properties of an optimal contract that were derived in the course, i.e. you do not have to derive the solution to any optimization problem step-by-step.

1. Suppose effort is observable and verifiable (symmetric information).

   (a) For both effort levels $e = 0, 1$, determine the wage the firm pays to the engineer conditional on the demand, if it wants the engineer to choose effort level e.

   (10 Points)

   (b) Which effort level does the firm demand from the engineer in order to maximize its expected profit under symmetric information?

   (5 Points)

2. Suppose effort is not verifiable (asymmetric information).

   (a) Determine the wage the firm pays to the engineer conditional on the demand, if it wants the engineer to choose effort level $e = 0$.

   (5 Points)

   (b) Write down the firm's optimization problem if it wants the engineer to choose effort level $e = 1$.

   (5 Points)

   (c) Determine the solution to the optimization problem under (b), i.e. determine the wage conditional on the demand if the firm wants the engineer to choose effort level $e = 1$.

   (15 Points)

   (d) Which effort level does the firm demand from the engineer in order to maximize its expected profit under asymmetric information?

   (5 Points)

Problem 2 (45 Points)

Suppose banks are competing for employees in their private banking department. An employee either generates high or low earnings for the bank. High earnings are given by $x_H = 600$ and low earnings are $x_L = 200$. There are two types of employees, a good (G) and a bad (B) type. If the employee is of type G, earnings are high with probability $p^G = \frac{1}{2}$, and if the employee is of type B, earnings are high with probability $p^B = \frac{1}{4}$. The banks do not observe an employee's type, but they know the proportion q of type G employees, where $0 < q < 1$.

The banks are risk neutral and want to maximize their expected profits. All employees are risk averse and their von Neumann-Morgenstern utility function over wage income is given by

$$u(w) = 1 - \frac{1}{w} \quad \text{for } w > 0.$$

Effort is costless and there is only one possible effort level, which can be ignored accordingly.

A contract specifies a wage w_H paid to an employee in case of high earnings and a wage w_L paid to an employee in case of low earnings.

When answering the following questions you can use all properties of the equilibrium contracts that were derived in the course for the case of competition between principals.

1. Determine the separating contract menu the banks offer to the employees in equilibrium, if the proportion q of type G employees is sufficiently small.

(25 Points)

2. Suppose the employees can signal their type by obtaining a master degree in finance before applying for the job at a bank. The effort cost for such a degree is $v^B = 1$ for type B and $v^G = 0$ for type G. Show that there exists a perfect Bayesian equilibrium, where only type G obtains a master degree. Determine the beliefs of the banks concerning the employee's type if the employee has (does not have) a master degree. Which contract do the banks offer to an employee if he has (does not have) a master degree?

(20 Points)