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1. Short questions:

a) Chris has the following elementary utility function: $v(c) = \sqrt{c}$, where c is the value of Chris' fortune which consists of a house worth 25. The likelihood of a fire reducing the value of the house to 0 is 20%. Chris has to take a decision on whether to buy fire insurance. The insurance contract on offer specifies a premium $P = 9$ and a deductible $D = 7$. Will Chris buy insurance?

b) What is a "complete asset market"? State all the conditions that need to be satisfied for an asset market to be complete.

c) Consider entrepreneurs (agents) who need to borrow money to set up production facilities. The entrepreneurs can turn to a bank (the principal) which provides loans of size k (at cost k). The repayment of entrepreneurs is given by t. The bank's profit from offering a loan is thus given by $V = t - k$. The value of an entrepreneur's output P is determined by the size of the loan and his/her type: $P(k, \Theta) = 3\Theta k^{\frac{1}{3}}$, where $\Theta = \underline{\Theta} = 1$ if the entrepreneur is inefficient and $\Theta = \overline{\Theta} = 4$ if the entrepreneur is efficient. (Note: a higher Θ implies higher efficiency!) The entrepreneur's profit is given by $U_\Theta = P(k, \Theta) - t$. Given that the bank has all bargaining power and has perfect information regarding the type of entrepreneurs, determine the contracts $(\underline{k}, \underline{t})$ and $(\overline{k}, \overline{t})$ that will be offered to inefficient and efficient entrepreneurs, respectively.

d) What is "nonresponsiveness"? Explain under which type of informational asymmetry it may occur and how it arises. What type of contract will a principal offer to deal with "nonresponsiveness"? (Note: no formulas, just words!)

2. Consider a market with a monopsonist employer. There are two types of workers. Type 0 has marginal productivity $\Theta_0 = 1$ and an outside opportunity wage of $w_0(\Theta_0) = \frac{3}{2}$. Type 1 has marginal productivity $\Theta_1 = 4$ and an outside opportunity wage of $w_0(\Theta_1) = 3$. The cost of education z is given by $C(z, \Theta_0) = \frac{z}{\Theta_0} = z$ for type 0 and $C(z, \Theta_1) = \frac{z}{\Theta_1} = \frac{z}{4}$ for type 1. A worker's utility function is defined by $U(w, z, \Theta) = w - C(z, \Theta)$. Workers know their own type but the employer cannot tell the high from the low productivity workers.

   a) Illustrate in a figure, with wage on the y-axis and the amount of education on the x-axis, which contracts will make it possible to separate type 1 from type 0 workers.

   b) What contract will the monopsonist offer? For simplicity assume that, if two contracts yield a worker the same level of utility, the worker prefers the one with less education. Illustrate your answer in the same figure as before.

   c) What contract would be offered under the competitive (Nash) equilibrium? Illustrate your answer in the same figure as before.

   Now suppose that the reservation wage of type 0 workers increases to $\widehat{w}_0(\Theta_0) = \frac{9}{4}$, while it remains the same for type 1 workers ($w_0(\Theta_1) = 3$).

   d) Illustrate in the same figure as before which contracts will make it possible to separate type 1 from type 0 workers.

   e) What will the outcome be when there is a monopsonist employer? Illustrate your answer in the same figure as before. Is this outcome more or less efficient than the one in b)? Motivate your answer.

   f) What contract would be offered under the competitive (Nash) equilibrium? Illustrate your answer in the same figure as before. Is this outcome more or less efficient than the one in c)? Motivate your answer.

3. The owner of a farm hires a worker to grow crops. The crop yield is random (depending on e.g. weather conditions), either high ($\overline{S} = 6$) or low ($\underline{S} = 1$). However, the probability of the crop yield being high π_e also depends on the effort $e \in \{0, 1\}$ that the worker exerts, such that $\pi_0 = \frac{1}{10}$ and $\pi_1 = \frac{1}{2}$. The cost that the worker incurs from exerting effort e is $\Psi(e) = e$. The farm owner, who is the only employer, offers a contract $(\underline{t}, \overline{t})$ that specifies the transfers to be paid to the worker, depending on the crop yield. The farm owner's expected profit is given by $EV_e = \pi_e(\overline{S} - \overline{t}) + (1 - \pi_e)(\underline{S} - \underline{t})$, and the worker's expected utility is given by $EU_e = \pi_e\overline{t} + (1 - \pi_e)\underline{t} - \Psi(e)$.

   a) State the participation constraint of the worker for contracts that specify effort $e = 1$.

   b) State the farm owner's optimization problem under complete information.

   c) What high-effort-inducing contract(s) will be offered?

   Assume now that information regarding the worker's actions is hidden to the farm owner.

   d) Which constraints need to be satisfied?

   e) What high-effort-inducing contract(s) will be offered?

   f) If the worker's liability is limited such that losses from transfers cannot exceed 0, which constraints need to be satisfied? What high-effort-inducing contract(s) will be offered?

   g) Provide an intuitive explanation for why hidden action and limited liability leads to a decrease in the farm owner's profits in this model. (No formulas, just words!)

   h) Illustrate your answers in c), e) and f) in a figure, with $\underline{t}$ on the x-axis and $\overline{t}$ on the y-axis.