Problem 1

a) When the monopolist can perfectly observe the consumer's type, he may capture all of the surplus by appropriate choice of payments t. Thus, to maximize profits he will choose the first-best levels of q, and then set $t_I = 5\ln\left(q_I^{FB}+1\right)$ and $t_R = \ln\left(q_R^{FB}+1\right)$. So all we need are the first-best quantity levels. Solving:

$$\max 5\ln(q_I+1) - cq_I \Rightarrow \frac{5}{q_I+1} = c \Rightarrow q_I^{FB} = \frac{5}{c} - 1$$
$$\max \ln(q_R+1) - cq_R \Rightarrow \frac{1}{q_R+1} = c \Rightarrow q_R^{FB} = \frac{1}{c} - 1$$

and plugging in we find that $t_I = 5\ln\left(\frac{5}{c}\right)$ and $t_R = \ln\left(\frac{1}{c}\right)$ (both are greater than zero since $c < 1$).

b) There will be an IC and an IR constraint for each type:

$$5\ln(q_I^*+1) - t_I^* \geq 0 \qquad (IR_I)$$
$$\ln(q_R^*+1) - t_R^* \geq 0 \qquad (IR_R)$$
$$5\ln(q_I^*+1) - t_I^* \geq 5\ln(q_R^*+1) - t_R^* \qquad (IC_I)$$
$$\ln(q_R^*+1) - t_R^* \geq \ln(q_I^*+1) - t_I^* \qquad (IC_R)$$

At the first-best, both types receive zero utility. Let us examine IC_I. If (q_R^*, t_R^*) are set to the first-best levels, an industrial consumer who pretends to be a residential consumer would receive $5\ln(q_R^*+1) - t_R^* = 5\ln(q_R^*+1) - \ln(q_R^*+1) = 4\ln(q_R^*+1) > 0$. Thus an industrial consumer's IC is not satisfied at the first-best.

c) The proposed q_I^* is of course the first-best quantity for the industrial customers. This is to be expected given the general "no distortion at the top" property of screening problems. Intuitively, the the industrial customers have the highest marginal valuation for service. Since they are the most efficient producers of surplus, the monopolist prefers to set their quantity levels at the efficient one (and then extract as much rent as he can, given the constraints). The propsed t_R^* is the one that sets the residential consumer's surplus to zero. If this net surplus were positive, the monopolist could raise the charge to all consumers without affecting the constraints, and make more money.

d) (Typo: The problem meant to say derive the implied relationship between t_I^* and q_R^*. The relationship between t_I^* and q_I^* is uninteresting given the assumptions of part c) which determine q_I^*!).The IC_I is an equality:

$$5\ln(q_I^*+1) - t_I^* = 5\ln(q_R^*+1) - t_R^*$$

Plugging in the part c) assumptions:

$$5\ln\left(\frac{5}{c}\right) - t_I^* = 4\ln(q_R^*+1) \Rightarrow t_I^* = 5\ln\left(\frac{5}{c}\right) - 4\ln(q_R^*+1)$$

Thus the transfer received from industrial customers is decreasing in the quantity offered the residential consumers. The monopolist would like to raise q_R^*

and thus increase the revenue from residential consumers (at least as long as $q_R^* < q_R^{FB}$) but doing so increases the incentives of the industrial consumers to pretend to be residential and so he must also lower t_I^*. To properly evaluate this trade-off, the monopolist would have to know the fractions of industrial and residential consumers in the population.

e) This is an adverse selection problem, since customers are privately informed about some aspect of their demands at the time the monopolist chooses his pricing structure. The inefficiency will arise from the desire of the monopolist to lower q_R^* below its first-best level so as to increase his profits from industrial consumers.

Problem 2

a) Since we have taken Cal to be risk-averse, it must be that $\rho > 0$.

b) Since Fred is risk-neutral and Cal is risk-averse, it follows that all efficient allocations have Fred bearing all of the risk; Cal's income will be constant across states of the world. For example, if y is thetotal amount of money available to the agents, and Cal must receive 10 dollars in certain equivalent, an efficient allocation might have Cal's income $= 10$ for sure, while Fred's income equals $y - 10$, which is a random variable with mean $\mu - 10$ and variance σ^2.

c) The efficient level of e must maximize the mean of y net of Cal's cost of effort. Thus

$$\max_e e - \frac{5}{2}e^2 \Rightarrow 1 - 5e = 0 \Rightarrow e^* = \frac{1}{5}$$

Cal's outside option of 10 dollars is irrelevant for the optimal choice of e.

d) This is the linear model; see the moral hazard notes for details of the derivation. The optimal b in this case is given by

$$b^* = \frac{1}{1 + 5\rho\sigma^2}$$

since for this case $C'' = 5$. From the first-order condition that $C'(e) = b$ we have $e^* = \frac{1}{5+25\rho\sigma^2}$. We may determine a from the equation

$$a + b^*e^* - \frac{5}{2}e^{*2} - \frac{1}{2}\rho b^{*2}\sigma^2 = 10$$

e) First, since $b \neq 0$, the Cal bears too much risk relative to the first-best solution (in which he bears no risk). On the other hand, since both $\rho > 0$ and $\sigma^2 > 0$, e^* is too low. This reflects the trade-off between insurance and incentives.

f) With $p > 1$, effort is now relatively more valuable. We would expect the optimal b^* to increase. In fact, if you are somewhat clever, you can determine that in this model

$$b^*(p) = \frac{p}{1 + 5\rho\sigma^2}$$

Problem 3

Obviously, what constituted a correct answer to these questions was somewhat more subjective. Credit was given insofar as answers reflected legitimate economic reasoning using the tools of this course. The following are what I thought about the problems:

a) Obviously, Intel wanted to price discriminate. On the other hand, presumably all consumers prefer higher quality chips. The key is that different types of consumers may have different preferences for quality. Intel would like to charge a high price for the higher quality item. This may drive away too many of the consumers who do not value quality highly. By introducing the damaged chip, Intel can sell to those consumers while maintaining a high price on the more sophisticated users who required a more powerful chip. This is an adverse selection problem; if Intel could observe a consumer's preference for quality, it could adjust the price of the fully functional chip to extract all surplus from each type.

b) Certainly offering automatic insurance on purchases bought by credit card makes consumers purchase more items on credit. But lowering the price would do the same thing; one has to come up with a reason why insurance coverage is the best way to do this. Perhaps insurance companies have some advantage in gathering information about the habits and purchases of their customers (alleviating adverse selection). But presumably they especially have this information regarding purchases actually made through the credit card, and not on all purchases made. To offer blanket insurance (albeit at a price) may not be profitable when these informational advantages are not present.

c) The question stipulates that both wealthier and better financially skilled borrowers are less likely to default. The average property price in a neighborhood indicates the incomes of the residents; therefore higher property prices lead to lower rates. Similarly, credit histories demonstrate financial prudence, and better credit history leads to lower rates. Which criterion a lender would prefer seems mainly to depend on which of the two is a better signal of default risk, given the equilibrium behavior of the agents. Certainly poorer, good-risk buyers prefer the credit-history criterion, and so on. A lot could be said about competition among lenders; the main thing is to take account of the possible problems of adverse selection when choosing strategies.

d) I don't think this was simply an example of the breakdown in bargaining that occurs in, say, the buyer seller model when agents are uncertain about others values. I would say it was pretty much common knowledge that there was a positive amount of money to be divided among the two sides. More important, in my view, was the desire of the two sides to signal their "toughness" which will have value in future labor negotiations. For instance, proving that you're very patient can be very profitable. Perhaps the lockout could have been shortened by publicly demonstrating "toughness" in some way; perhaps by offering public proof of extreme wealth as a signal of your ability to survive the lockout for a long period of time.

e) Here we refer to the result that in adverse selection models of buyers and sellers assymetric information about agents' valuations can lead to mutually beneficial trades not taking place. Mechanism for screening or selecting among buyers may be helpful in these cases.