University of British Columbia
Department of Economics

Economics 221 (002 & 003)
December 2010
M. Vaney

Final Examination

Part	*Points Available*	*Points Earned*
A	40	
B.1	20	
B.2	20	
B.3	20	
Total	**100**	

Instructions

1. Check that your name and student number are on this cover page.
2. There are **15** pages to this exam (not including this cover page). Make sure you have all pages.
3. This exam is closed book and closed notes.
4. Answer *all* questions in part A. Answer *all* questions in part B.
5. You may use non-programmable, non-graphing calculators.
6. The exam has a total of 100 points. You have 150 minutes to complete this exam.
7. You may not leave the exam room during the last 10 minutes of the exam. Stay in your seat until the invigilator collects your exam and dismisses the class.
8. **DO NOT BEGIN THE EXAM UNTIL INSTRUCTED TO DO SO.**

The University of British Columbia holds academic integrity as a core value of the institution. The penalties for cheating in an exam may include expulsion from the University and a notation of misconduct discipline on the student's transcript of academic record.

GOOD LUCK

PART A: ***Answer all questions.*** **Each question is worth 10 marks.**

1. In a Spence signalling model where high-ability workers can signal high ability at cost c^H but low-ability are unable to send the same signal, describe the conditions on c^H, w^H, w^L and θ^H where both a pooling and separating equilibrium are possible. A figure may help in your descriptions of the conditions but you should also provide some explanation of how it is possible that both types of equilibria could arise.

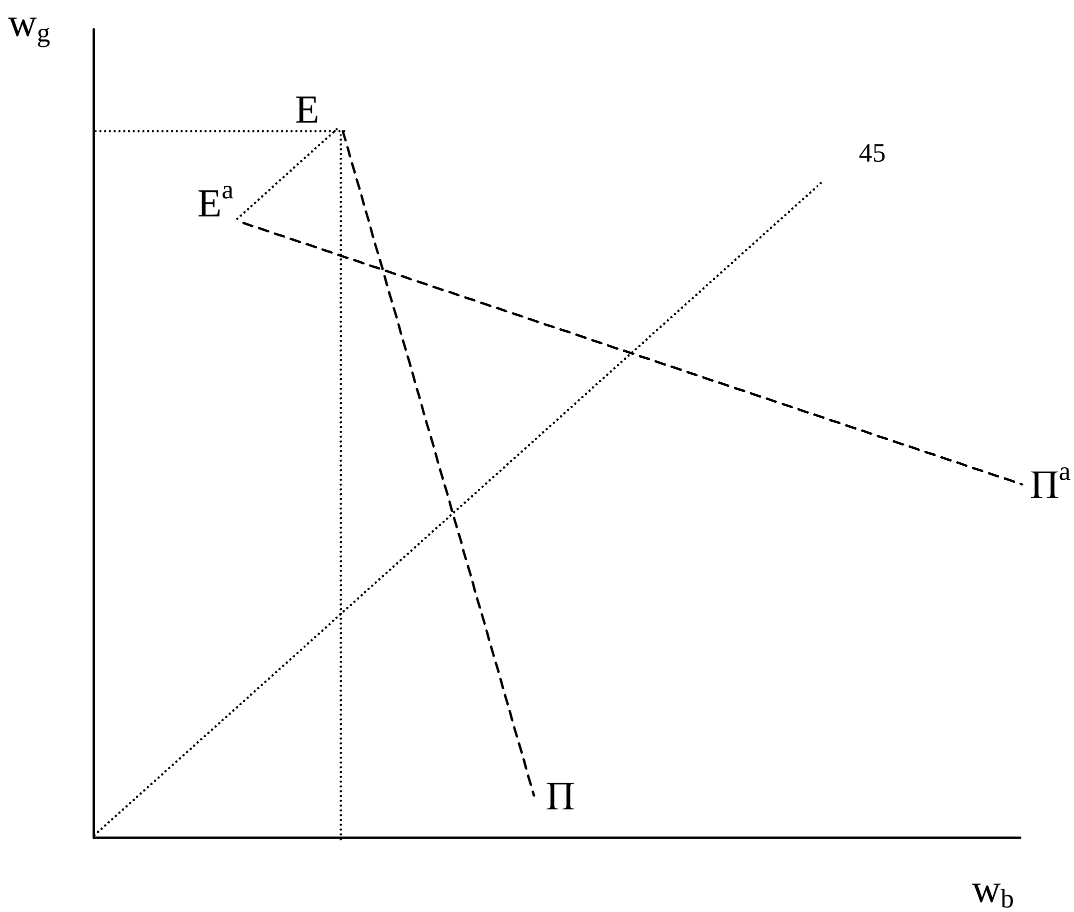
2. The current price of gold is $P_0 = \$1400$. The price of gold may either be high P_H or low P_L at the end of an investment period. An advisor counsels an investor to either purchase one ounce of gold today (Purchase) or sell one ounce of gold today and hold cash (Sell). The advisor knows the future price of gold. The investor does not, but does know the distribution over possible values: $prob(P_H) = \frac{1}{3}$. Payoffs depend on the action taken by the investor and the price of gold:

	Investor		Adviser	
	$P_H = \$1600$	$P_L = \$800$	$P_H = \$1600$	$P_L = \$800$
purchase	$.9\,(P_H - P_0)$	$(P_L - P_0)$	$.1\,(P_H - P_0)$	\$75
sell	$(P_0 - P_H)$	$.9\,(P_0 - P_L)$	0	$.1\,(P_0 - P_L)$

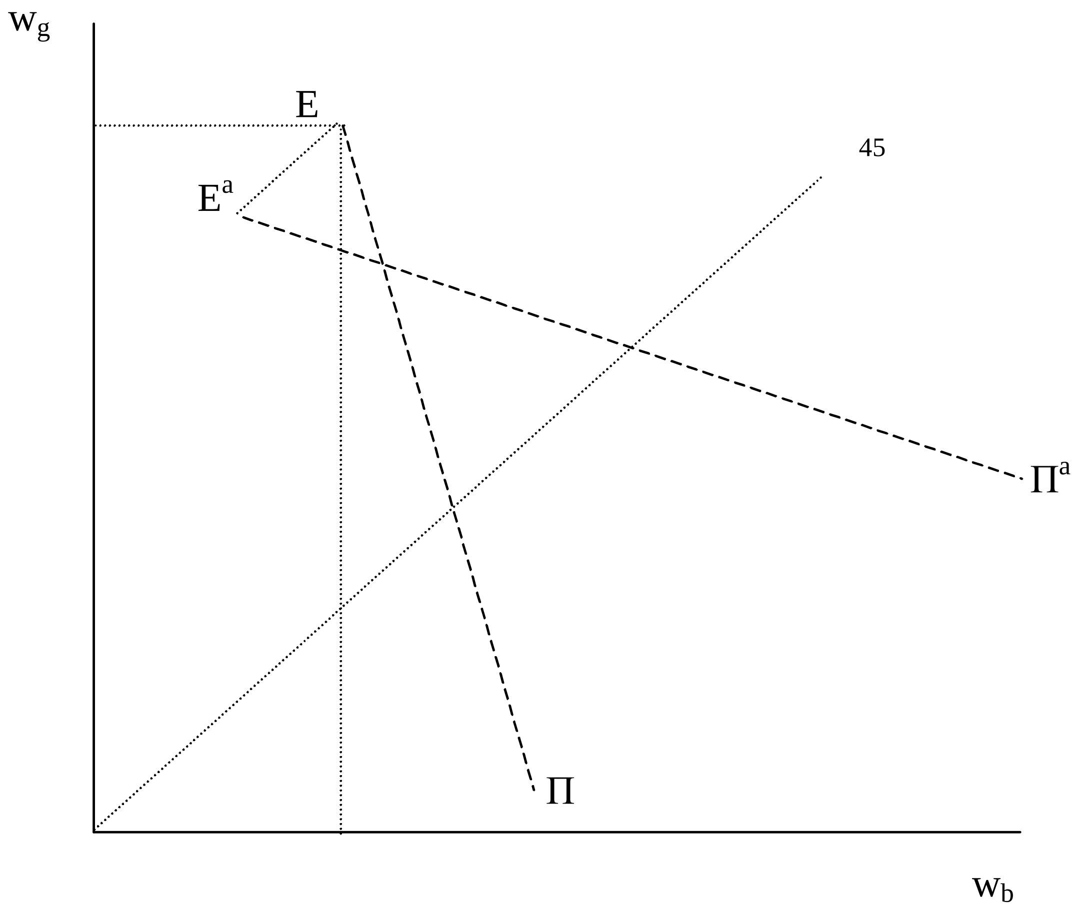
The advisor is being provided with a payment from the firm (\$75) for getting the investor to purchase some of the firm's gold when the price is going to drop. Explain whether there will be a cheap-talk equilibrium where the advisor provides honest advice to the investor. Does the probability distribution over P_H and P_L influence the answer?

3. In a world of uncertainty, there is a good state (g) where nothing happens to an individual's car. In the bad state (b), the car will be broken into and vandalized resulting in a reduction in the wealth of the individual. The probability of the bad state is π_b. It is possible for the individual to pay c^a to keep the car in a secure garage which reduces the probability of the bad state to $\pi_b^a < \pi_b$. The figures below show the wealth of the individual in each state of the world when no action is taken (E) and when the costly action is taken (E^a). Π and Π^a are lines with slopes $\frac{-\pi_b}{1-\pi_b}$ and $\frac{-\pi_b^a}{1-\pi_b^a}$ respectively.

   (a) If no insurance is available, draw indifference curves consistent with the individual choosing to incur cost c^a to park in the secure garage. *(4 marks)*



(b) A competitive insurance company is unable to verify that the individual parks in the garage. The insurance company sets a fair premium rate $\gamma^a = \pi_b^a$ to individuals who report taking the action. Using indifference curves, show the highest level of coverage the insurance company can provide without encountering problems of moral hazard. *(6 marks)*



4. According to the AFL-CIO (www.aflcio.org), James Dimon, Chairman and CEO of JPMorgan Chase & Co. was paid a salary of $\$1,000,000$ in 2009. In addition to his salary, he received $\$14,196,700$ in performance-based compensation that was tied to the price of JPMorgan stock. Explain why the total compensation to Mr. Dimon might be structured in this fashion and what constraints guide setting the values of the salary and bonus.

PART B: ***Answer all questions.*** **Each question is worth 20 marks.**

1. Two firms compete in a duopoly industry. Each firm can set prices at either a high (H) or low (L) level. The payoffs (profits) to each firm can be shown in the following game matrix:

		Firm II	
		H	L
Firm I	H	(10,10)	(2,14)
	L	(14,2)	(4,4)

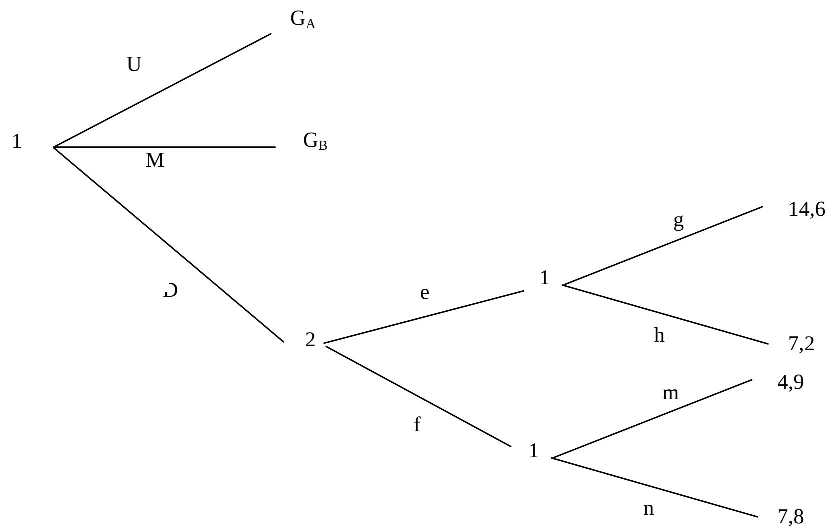
   (a) When this game is played just once, explain what the equilibrium to the game will be. What type of equilibrium is this? *(4 marks)*

   (b) If the game is repeated three times, what will the equilibrium strategy of each player be? *(4 marks)*

(c) Suppose that the game is actually repeated an infinite number of periods. Future period payoffs can be discounted using the discount factor δ, with $0 < \delta < 1$. You are reminded that $\delta + \delta^2 + \delta^3 + \delta^4 + \ldots = \frac{\delta}{1-\delta}$. Find the minimum value for the discount factor that will sustain a cooperative outcome by the players ($\{H, H\}$ every period), on the assumption that the players adopt grim-trigger strategies. *(6 marks)*

(d) Find the minimum discount factor necessary to sustain collusion when there is a delay to the onset of punishment. For example, if firm I cheats/deviates at t, this is detected at the end of t but firm II is unable to commence punishment until $t+2$ (rather than $t+1$). Explain whether this delay makes it easier or more difficult to sustain cooperation. *(6 marks)*

2. Consider the following game tree:



where G_A and G_B are simultaneous move games given by the matrices:

$G_A =$

		Player 2	
		l	r
Player 1	u	$(7, 4)$	$(2, 2)$
	d	$(3, 3)$	$(11, 5)$

and

$G_B =$

		Player 2	
		s	t
Player 1	v	$(9, 3)$	$(6, 2)$
	w	$(11, 1)$	$(12, 2)$

(payoff to player 1, payoff to player 2)

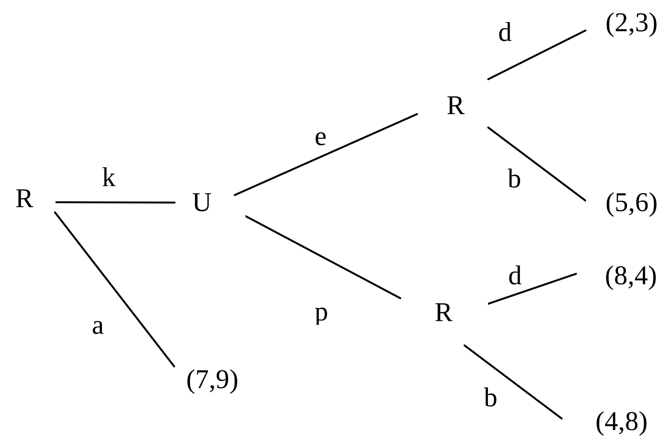
(a) How many subgames does this game have? *(4 marks)*

(b) What is an information set? How many information sets does each player have? *(5 marks)*

(c) Find all the Nash equilibria to the subgame G_A (pure and mixed strategy). *(5 marks)*

(d) Find all the subgame perfect Nash equilibria to the entire game. *(6 marks)*

3. The U.N. (player U) is concerned with the weapons program of a Rogue dictator (player R). The U.N. has sent weapons inspectors to the country, if R allows (a) the inspectors to carry out their program then the game will come to an end. If R chooses to kick out (k) the inspectors, then U must choose how to respond (Escalate (e) or take a Passive role (p)) and R will then choose whether to remain defiant (d) or Back down (b). The game tree can be shown as follows (payoff to R, payoff to U):



(a) Find the subgame perfect Nash equilibrium to this game. *(4 marks)*

(b) Suppose that the Rogue dictator may be one of two types. The Sane type, R_S has payoffs as described in the game tree above. There is also a Crazy type, R_C. The Crazy type likes confrontation and likes to be defiant. For the Crazy type, the game is as above except for two changes to the payoffs of R_C:

1. if R_C allows the inspectors then R_C will receive a payoff of 3 (not 7)

2. when R plays k, U plays e and R plays d the payoff to R_C is 9 instead of 2.

The Rogue dictator knows his type. The U.N. is unable to observe the type but does know that the probability of the dictator being Sane is $\pi = \frac{1}{2}$. Use Nature as an additional player to draw the game tree. *(4 marks)*

(c) Consider an equilibrium where R_C plays a single action, but both R_S and U follow mixed strategies. R_S plays k with probability α (and a with probability $1 - \alpha$) and U plays e with probability β (p with probability $1-\beta$). Find the equilibrium (pure) strategy of type R_C and find the equilibrium (mixed) strategy of U (β and $1 - \beta$). (recall $\pi = \frac{1}{2}$) *(5 marks)*

(d) To complete the description of the equilibrium from (c), look for the mixed strategy that is followed by R_S. It will be necessary to derive expressions for the beliefs of U if they observe k, i.e. $\mathbb{P}(R_S|k)$ and $\mathbb{P}(R_C|k)$. Find the equilibrium mixed strategy of R_S (α and $1-\alpha$) and the beliefs of U regarding the type of player they face when they observe k being played. *(7 marks)*