Stockholm University

Department of Economics

Course name:	**Economic Strategic Thinking**
Course code:	**EC2109**
Semester:	**Spring 2015**
Type of exam:	**MAIN**
Examiner:	**Robert Östling**
Number of credits:	**7,5 credits (hp)**
Date of exam:	**Monday 16 March 2015**
Examination time:	**3 hours (14:00-17:00)**

Write your identification number on each paper and cover sheet (the number stated in the upper right hand corner on your exam cover).

Use one cover sheet for all questions in Part A and one cover sheet per question in Part B. Explain notions/concepts and symbols. If you think that a question is vaguely formulated, specify the conditions used for solving it. Only legible exams will be marked. **No aids are allowed.**

The exam consists of 7 questions. Each question is worth 8 to 40 points, 100 points in total. For the grade E 45 points are required, for D 50 points, C 60 points, B 75 points and A 90 points.

Up to 10 extra credit points earned from the home assignments and active participation in the class experiment may be added to the raw score for the written exam.

Your results will be made available on your “My Studies” account (www.mitt.su.se) on Wednesday 8 April 2015 at the latest.

Good luck!

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PART A: Multiple-choice questions

Indicate one alternative per question only. Correct answers give 8 points, incorrect answers minus 2 points.

QUESTION 1 (8 POINTS)

Anne, Bob and Francisco at Obscure Advice Corporation have scheduled a meeting to discuss a possible joint venture with Strategic Thinking Inc. Before the meeting, they decide independently and simultaneously whether to put in extra effort in order to come on time for the meeting or not. The meeting cannot start until all three are present. Supposing the payoffs of the players are represented by the payoff tables below, what is the pure-strategy Nash equilibrium (NE) prediction for what will happen? Payoffs are denoted as usual, i.e. "X,Y,Z" means X to Anne, Y to Bob and Z to Francisco.

Francisco comes on time

		Bob	
		On time	Late
Anne	On time	10,10,10	0,5,0
	Late	5,0,0	5,5,0

Francisco comes late

		Bob	
		On time	Late
Anne	On time	0,0,5	0,5,5
	Late	5,0,5	6,6,6

(A) The only pure strategy NE is that all three come late.
(B) The only pure strategy NE is that all three come on time.
(C) There are two pure strategy NE: either they all come on time or they all come late.
(D) There are three pure strategy NE: one is on time and the other two are late.
(E) None of the above alternatives.

QUESTION 2 (8 POINTS)

Suppose there are high- and low-quality producers of espresso machines. The risk that the low-quality producer's espresso machine breaks down in a year is 20%, whereas it is only 10% per year for the high-quality producer's machine. It costs the producer 5000 SEK to repair an espresso machine. Suppose the high-quality producer offers a warranty of X years that covers all repairs. The expected cost of an X year warranty is consequently 0.20*X*5000 for the low-quality producer and 0.10*X*5000 for the high-quality producer. Suppose that the production cost is zero and that customers are willing to buy a high-quality machine for 10000 SEK, but a low-quality one for only 5000 SEK. If no warranty is provided, customers assume the machine is of low quality. For what range of X values can a warranty be used as a signal to credibly distinguish a high-quality producer from a low-quality producer?

(A) There is no separating outcome in this case.
(B) Any warranty between 5 and 10 years would work to separate high and low-quality producers.
(C) A warranty between 10 and 20 years would work to separate high and low-quality producers.
(D) Any warranty of more than 5 years would work to separate high and low-quality producers.
(E) Any warranty of less than 10 years would work to separate high and low-quality producers.

QUESTION 3 (8 POINTS)

Two students, Minya and Alexandre, are attending a boring lecture and therefore start playing a game where they simultaneously should write either "Bob" or "Francisco" on a piece of paper. Minya is also considering not to participate by leaving the paper blank and focus on the listening to the lecturer instead. Which statements are true about the mixed strategy Nash equilibrium of this game supposing the payoffs are described by the table below?

		Minya		
		Bob	Francisco	Leave blank
Alexandre	Bob	1,2	2,1	0,0
	Francisco	2,1	1,2	0,0

(A) Both players play each strategy with equal probability.
(B) Alexandre plays "Bob" and "Francisco" with probability 0.5, Minya plays "Bob" with probability 0.4, "Francisco" with probability 0.4 and leave blank with probability 0.2.
(C) Both Alexandre and Minya play "Bob" and "Francisco" with probability 0.5
(D) This game does not have a mixed strategy Nash equilibrium.
(E) None of the above alternatives.

QUESTION 4 (8 POINTS)

Suppose two producers, let's call them Globex and Mapple, are both developing a new, mind-controlled smartphone. They can either choose to launch the product this year with some bugs (for example that it is sometimes also controlled by unconscious thoughts) or wait until next year when the product is completely developed. The total demand for the unfinished product corresponds to a total profit of 0.5 quadrillion bitcoins in the first year (and no profit in the second if the product is released in the first). If both companies release the product in the same year, they share the profit equally. If none of the firms release the product the first year, they face a choice whether to launch the product the next year instead. Next year all bugs will be fixed and the demand corresponds to a total profit of 1 quadrillion bitcoins. Assuming that the firms want to maximize profits and that a bitcoin is worth the same this year as next, what is the subgame perfect Nash equilibrium (SPNE) of this game? We restrict attention to pure strategies only and the payoffs are summarized in the tables below.

Year 1

		Mapple	
		Release product	Wait
Globex	Release product	0.25,0.25	0.5,0
	Wait	0,0.5	See table below

Year 2

		Mapple	
		Release product	Wait
Globex	Release product	0.5,0.5	1,0
	Wait	0,1	0,0

(A) The unique SPNE is that they both release the product in year 1.
(B) The unique SPNE is that they both release the product in year 2.
(C) The unique SPNE is that no firm release the product at all.
(D) There are two SPNE: Either the firms both release it in year 1 or they both release the product in year 2.
(E) There are two SPNE in which one firm releases the product in year 1 and the other firm in year 2.

QUESTION 5 (8 POINTS)

Suppose player 1 can credibly commit to taking action B in the simultaneous-move game shown below. How would player 1's payoff be affected by this commitment possibility? In other words, what is the payoff of the Nash equilibrium of the simultaneous-move game compared to the subgame perfect Nash equilibrium of the game where player 1 can choose to commit to playing B?

		Player 2	
		A	B
Player 1	A	40,20	15,40
	B	30,20	10,10

(A) Player 1's payoff is 30 higher with the commitment option.
(B) Player 1's payoff is 25 higher with the commitment option.
(C) Player 1's payoff is 15 higher with the commitment option.
(D) Player 1's payoff is 10 higher with the commitment option.
(E) Player 1 would not choose to commit and his/her payoff would therefore be unchanged.

PART B: Open-ended questions

Clearly motivate your answers to the following questions and explain any calculations that you make!

QUESTION 6 (20 POINTS)

Two parents come home after a weekend in the summer house and discover that a bottle of expensive wine is missing. The parents naturally suspect that it is one of their three teenage kids – Alice, Bob or Cassandra – that have taken it. It was in fact Alice that took the wine, but the parents do not know this. The parents are inspired by a game theory problem they recently solved and tell their children to simultaneously either write "Yes, I took the bottle" or "No, I did not take it" on a piece of paper. They announce that if at least one of them claims that they took the bottle, those that admit will get the normal weekly allowance of 100 SEK during the coming month, whereas those that claim that they have not taken it will get 200 SEK. If none of them admits having taken the bottle, none of them get any allowance for the rest of the month.

(A) (5 POINTS) Write down the game tables for this game assuming their payoffs are given by the monetary amounts above. Make Alice the row player, Bob the column player and let Cassandra choose which table to play.

(B) (5 POINTS) Find all the pure strategy Nash equilibria of this game.

(C) (5 POINTS) The game has several Nash equilibria. Is there any of these equilibria you consider to be a focal point?

(D) (5 POINTS) The parents are primarily interested in figuring out which child took the wine, not so much about punishing the child who took it. What are the pros and cons with the parents' solution above? Is there some other solution you would recommend?

QUESTION 7 (40 POINTS)

Recently a measles outbreak began at Disneyland in Los Angeles. The outbreak is believed to be caused by an increasing number of parents in California that choose not to vaccinate their children. The vaccine is provided freely to children in the United States, but some parents worry that the vaccine might cause autism. Their worry originates with a research article published in a leading medical journal in 1998, but that article was later shown to be fraudulent.

Suppose there is a small isolated island with a population of 3000 people that are considering whether to take a vaccine. There is a small cost of taking the vaccine (for example due to the hazzle of taking it and misplaced worries about autism). The benefit of taking the vaccine is that you will not get the disease. The risk of getting the disease if you have not taken the vaccine is decreasing in the number of people taking the vaccine.

Let's assume that the cost of taking the vaccine is 5 utils, the suffering if you get the disease is 1000000 utils and the probability of getting measles is $p = 1/100n$, where n is the number of vaccinated people. Let us also assume that you are fully protected against measles if you take the vaccine.

(A) (5 POINTS) Draw a diagram showing the payoff of not taking the vaccine when n other people are taking the vaccine. Use the same diagram to also show the payoff from taking the vaccine. It is sufficient to draw the diagram for n = 500, 1000, 1500 and so on up to 3000

(B) (5 POINTS) How many will take the vaccine in Nash equilibrium?

(C) (5 POINTS) What is the total payoff for the whole population if instead 2500 people take the vaccine? Is this higher or lower than your answer to (B) and why is it so?

(D) (5 POINTS) Suppose now that the population consists of an additional 100 children that simply cannot take the vaccine for medical reasons. The risk of getting the disease and the suffering it causes is the same as before and it is the same for these children as for the rest. How does the existence of these children change the answer to part (B)?

(E) (5 POINTS) How does the additional 100 children change your answer to part (C)?

(F) (7.5 POINTS) Discuss the strategic situation above and relate to other similar situations discussed in the course.

(G) (7.5 POINTS) Propose at least three potential and reasonably realistic solutions to the growing problem that parents refuse to vaccinate their children.

Note that you can answer part (F) and (G) of this questions even if you have not successfully solved (A) to (E), but make be sure to state any additional assumptions you need to make in order to answer (F) and (G).