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Course name:	Economic Strategic Thinking
Course code:	EC2109
Type of exam:	Re-take
Examiner:	Robert Östling
Number of credits:	7.5 ECTS
Date of exam:	May 5, 2019
Examination time:	9:00-12:00
Aids:	No aids are allowed.

Write your identification number on each answer sheet (the number stated in the upper right hand corner on your exam cover). Use the multiple question answer sheet for all questions in Part A and regular answer sheets for Part B, start each new question on a new answer sheet.

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.

The exam consists of 7 questions. Each question is worth 8 to 36 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.

Your results will be made available on your Ladok account (www.student.ladok.se) within 15 working days from the date of the examination.

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)

Two students, Minya and Alexandre, think the lecture is boring and start playing a game where they simultaneously write either "Bob" or "Francisco" on a piece of paper. Minya is also considering the option to not participate by leaving the paper blank and listening to the lecturer instead. Which statement is 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 equal probability whereas 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 2 (8 POINTS)

There are two competing hamburger restaurants, Bob's Burgers (B) and McBob (M), that are considering how to price their burgers. Let B's price be denoted p_B and M's price p_M. B has to make its pricing decision first. M observes B's price and then sets its own price. The demanded quantity of B's burgers is given by $240 – 4p_B + 4p_M$ and demand for M's burgers is given by $240 – 4p_M + 4p_B$. Suppose the marginal cost to produce a hamburger is zero so that the profit of each restaurant is simply the price multiplied by the demanded quantity. What prices do the firms charge in the subgame-perfect Nash equilibrium of this game (assuming both firms maximize profits)?

(A) B charges 75 and M charges 90.
(B) B charges 90 and M charges 75.
(C) Both firms charge 60.
(D) Both firms charge 75.
(E) Both firms charge 90.

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QUESTION 3 (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 4 (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 to playing B and his/her payoff would therefore be unchanged.

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QUESTION 5 (8 POINTS)

Cass and Louie are an old married couple that every year has to independently decide whether they should buy Christmas gifts to each other. If one of them is not buying a gift, it is tempting to impress the other and buy a gift nevertheless (although this is very embarrassing for the one of them that did not buy a gift). However, since gifts are expensive, and it is difficult to find gifts the other really wants, they both prefer if none of them buy a gift. Cass and Louie's payoffs are represented by the payoff matrix below. Suppose they play the simultaneous-move game below infinitely many times. What is the highest effective rate of return, R, that is required for it to be a subgame perfect Nash equilibrium not to buy gifts? We only consider "grim trigger" strategies, i.e. no-gift play supported by a threat that both will buy gifts forever after if somebody bought a gift at one point in time.

		Louie	
		No gift	Buy a gift
Cass	No gift	2, 2	-2,4
	Buy a gift	4,-2	1,1

(A) R cannot be larger than 12.5 percent.
(B) R cannot be larger than 25 percent.
(C) R cannot be larger than 50 percent.
(D) It is never a subgame perfect Nash equilibrium for positive values of R.
(E) It is a subgame perfect Nash equilibrium irrespective of what R is.

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PART B: Open-ended questions
Clearly motivate your answers to the following questions and explain any calculations that you make!

QUESTION 6 (24 POINTS)
Consider a town with two plumbers, Pat and Ronni, who are considering what hourly rate their respective plumbing companies should charge in the coming year. If they charge a high rate, the profit is 25 SEK per hour whereas the low price only gives an hourly profit of 20 SEK. Each plumber has a contract with a local insurance firm that guarantees that they each get 1000 hours of work irrespectively of what rate they charge. In addition, there is a floating demand for 2000 hours of plumbing services, all of which will go to the plumber that charges the lowest price. If they both charge the same price, they get to provide 1000 hours each (in addition to the 1000 hours from the insurance company).

For example, if one plumber charges the low price and the other plumber the high price, the plumber that charges the low price earns 20*(1000+2000) = 60000 and the other plumber earns 25*1000 = 25000.

(A) (6 POINTS) Draw the payoff matrix for the simultaneous-move price-setting game where both plumbers choose whether to charge a high or low price and determine the Nash equilibrium.

(B) (6 POINTS) Explain why the game in (A) is a Prisoners' Dilemma game.

(C) (6 POINTS) Now suppose Pat has a contract with the insurance company of 5000 (rather than 1000) hours. Profit margins and the floating demand remain the same. Draw the payoff matrix for this game and find the Nash equilibrium. Is this game still a Prisoners' Dilemma game?

(D) (6 POINTS) How does the existence of a Pat's larger contract with the insurance company solve the dilemma? Relate your answer to other examples where similar resolutions of social dilemmas are plausible.

QUESTION 7 (36 POINTS)
A reoccurring phenomenon in the Western world are measles ("mässling" in Swedish) outbreaks that are caused by parents that choose not to vaccinate their children. The measles vaccine is provided freely to children, 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

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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, whereas the suffering if you get the disease is equivalent to a cost of 1000000. The probability of getting measles if you have not taken the vaccine is p = 1/100n, where n is the number people that are vaccinated. If you take the vaccine, we assume that you are fully protected against measles.

(A) (8 POINTS) Draw a diagram showing the payoff of not taking the vaccine when n other people are taking the vaccine. Plot the payoff on the vertical axis and n on the horizontal axis. Use the same diagram to also show the payoff from taking the vaccine. It is enough to draw the diagram for n = 500, 1000, 1500 and so on up to 3000

(B) (8 POINTS) How many will take the vaccine in Nash equilibrium?

(C) (8 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) (8 POINTS) Discuss the strategic situation above and relate to other similar situations discussed in the course.

(E) (4 POINTS) Propose at least one reasonably realistic solution to the growing problem that parents refuse to vaccinate their children.

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