

Written Exam at the Department of Economics winter 2020-21

**Microeconomics III**

Final Exam

15 January 2021

(2-hour open book exam)

Answers only in English.

***The paper must be uploaded as one PDF document. The PDF document must be named with exam number only (e.g. '127.pdf') and uploaded to Digital Exam.***

**This exam question consists of 4 pages in total**

**This exam has been changed from a written Peter Bangsvej exam to a take-home exam with helping aids. Please read the following text carefully in order to avoid exam cheating.**

**Be careful not to cheat at exams!**

You cheat at an exam, if you during the exam:

- Copy other people's texts without making use of quotation marks and source referencing, so that it may appear to be your own text. This also applies to text from old grading instructions.
- Make your exam answers available for other students to use during the exam
- Communicate with or otherwise receive help from other people
- Use the ideas or thoughts of others without making use of source referencing, so it may appear to be your own idea or your thoughts
- Use parts of a paper/exam answer that you have submitted before and received a passed grade for without making use of source referencing (self plagiarism)

You can read more about the rules on exam cheating on the study information pages in KUnet and in the common part of the curriculum section 4.12.

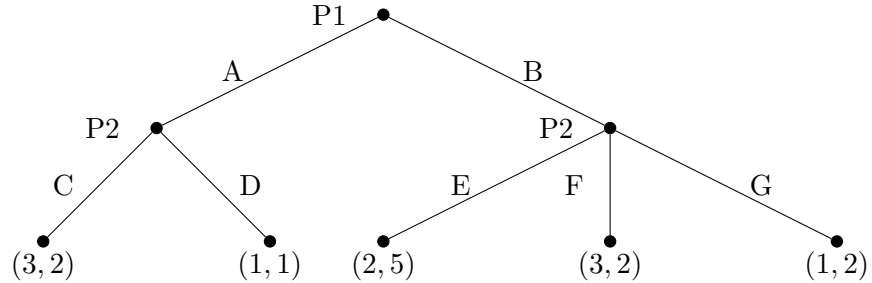
Exam cheating is always sanctioned with a warning and dispassing from the exam. In most cases, the student is also expelled from the university for one semester.

**Exam, January 15, 2021**

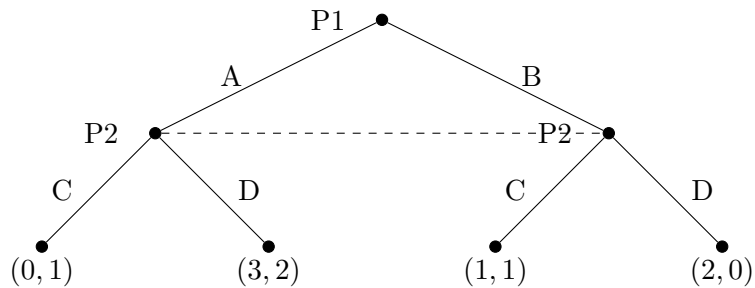
Your answers may include pictures of hand-written text, figures and equations. Please keep in mind that you are responsible for ensuring that your handwriting is easy to read and that the light is good in the picture. Make sure that you include page numbers and question numbers to your answers and that you mark your final answer clearly.

- Find all pure strategy subgame perfect Nash equilibria of the following games (the first payoff is that of player 1, the second payoff that of player 2). Remember to define full equilibrium strategies.

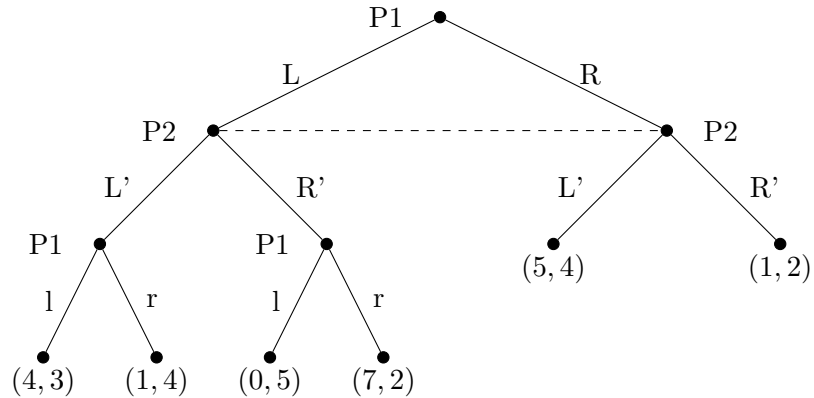
(a) (3 points)



(b) (3 points)



(c) (4 points)



2. Two firms choose simultaneously their levels of production,  $q_1$  and  $q_2$ . Firm 2 already has produced  $\bar{q} \leq 1/2$  and will have to sell that quantity no matter what.  $q_2$  is what Firm 2 can produce additionally so that its total supply is  $\bar{q} + q_2$ . Products are identical and the inverse demand is  $P(q_1, q_2, \bar{q}) = 1 - q_1 - q_2 - \bar{q}$ . The marginal cost of production is 0 for both firms.

(a) (1 point) Write the game in normal form.

(b) (4 points) For each  $\bar{q} \in [0, 1/2]$ , find the Nash equilibrium of the game. Does the storage help or hurt Firm 2? Discuss why (write 1-2 sentences).

(c) (1 point) Assume now that only Firm 2 knows  $\bar{q}$  and that it is 0 with probability 0.5 and  $1/2$  with probability 0.5. Write the game of incomplete information in normal form.

(d) (4 points) Find the Bayes Nash equilibrium of the game with incomplete information. Does incomplete information help or hurt Firm 2 compared to the case where also Firm 1 observes  $\bar{q}$ ? Discuss why (write 1-2 sentences).

3. Consider the following (simultaneous move/ static) stage game:

		Player 2		
		<i>a</i>	<i>b</i>	<i>c</i>
Player 1	<i>A</i>	1, 6	3, 2	6, 1
	<i>B</i>	0, 2	4, 4	5, 2
	<i>C</i>	2, 3	5, 1	2, 0

- (a) (4 points) Find all (pure and mixed) Nash equilibria of the stage game. Make sure that you have argued that there are no other Nash equilibria.
- (b) (6 points) Now, consider infinitely many times repeated game with discount factor  $\delta < 1$ . Show that if  $\delta$  is close to 1, there exists a subgame perfect Nash equilibrium where  $(B, b)$  is played in every period on the equilibrium path. Construct such an equilibrium, i.e. find equilibrium strategies.

EXTRA (+2 points) Solve the following normal form game by using the iterative elimination of strictly dominated strategies - remember also to eliminate strategies that are dominated by a mixed strategy. Explain briefly each step (1 sentence).

		Player 2		
		<i>a</i>	<i>b</i>	<i>c</i>
Player 1	<i>A</i>	1, 6	3, 2	1, 5
	<i>B</i>	1, 2	2, 4	3, 3
	<i>C</i>	2, 3	5, 1	0, 0