UNIVERSITY OF OSLO
DEPARTMENT OF ECONOMICS

Take home exam: **ECON5200/9200 – Advanced Microeconomics**

Exam period: Monday 11 December at 09.00 to Thursday 14 December at 15.00

Guidelines:
Submit your exam answer electronically to: submissions@econ.uio.no. Last day for submission is **Thursday 14 December at 15.00**

Written text should be in pdf format.

Use your candidate number, both as the name of the file you submit, and as the author name in the file. Do NOT use your name! You will find your candidate number on your StudentWeb. If you have problems, please contact the Department of Economics.

Further instructions:

- The questions are in English, and your answers must be given in English.
- Students on master's level are awarded on a descending scale using alphabetic grades from **A** to **E** for passes and **F** for fail. Students who would like to have the course approved as a part of our PhD-program, must obtain the grade B or better. Students on PhD-level are awarded either a passing or failing grade. The pass/fail scale is applied as a separate scale with only two possible results.
- Your answer must fill the formal requirements, found at http://www.sv.uio.no/studier/ressurser/skriver%C3%A5d/sv.html (Norwegian) or at http://www.sv.uio.no/english/studies/resources/sources-and-references/ (English).
- It is of importance that your paper is submitted by the deadline (see above). Papers submitted after the deadline, **will not be corrected**.*)
- All papers must be submitted electronically to the address given above. You must not submit your paper to the course teacher.

*) The standard regulation for illness during exam also applies for the home exams. Please see http://www.uio.no/english/studies/admin/examinations/illness-postponed/index.html for further details.

Each problem is given one third weight, and the sub-problems count equally within each of the three problems.

Problem 1

Please read carefully the two following papers by Jacques Drèze:

(1) "Existence and multiplicity of temporary equilibria under nominal price rigidities", *Economic Theory* **62**, 279–298 (2016a), and

(2) "When Borch's Theorem does not apply: some key implications of market incompleteness, with policy relevance today", *The Scandinavian Journal of Economics* **118**, 755–784 (2016b).

Respond to the following sub-problems:

(a) Explain the Borch Theorem in simple words, relate it to the Arrow-Debreu general equilibrium setting, and briefly discuss when it fails.

(b) Why does market incompleteness lead to multiple budget constraints for the individual?

(c) What is the difference between constrained efficiency and Pareto efficiency? Why do these coincide with complete markets?

(d) What are the main differences between the two following approaches: 'general equilibrium with incomplete markets' (GEI) and 'temporary general equilibrium' (TGE)?

(e) The main result of Drèze (2016a) is the existence and multiplicity of temporary equilibria. This leads to a simple relationship between 'output gap' and 'inflation' (eq. (9) in Drèze, 2016b). Can we conclude that inflating the economy worsens the output gap? Discuss.

(f) An important contribution is to allow for incomplete preferences of individuals and to allow firms to take decisions based on the 'control principle'. Assume instead that individuals' preferences are complete and that firms are each owned by only one individual. How do Drèze's results change?

Problem 2

Please read carefully the two following papers by Piccione and Rubinstein:

(1) "On the interpretation of decision problems with imperfect recall", *Games and Economic Behavior* **20**, 3–24 (1997a), and

(2) "The absent-minded driver's paradox: Synthesis and responses", *Games and Economic Behavior* **20**, 121–130 (1997b).

Respond to the following sub-problems:

(a) (i) What is meant by perfect recall in an extensive game?

(ii) Explain the difference between a mixed strategy and a behavioral strategy.

(iii) What does it mean that a behavioral strategy is outcome-equivalent to a mixed strategy?

The following result is known as Kuhn's theorem:

> If a finite extensive game has perfect recall, then for any player i and for each mixed strategy σ_i of player i, there is an outcome-equivalent behaviour strategy β_i of player i.

(iv) Provide a proof of Kuhn's theorem.

(v) Why does Kuhn's theorem require that the game has perfect recall? Give an example of a game without perfect recall where a player has a mixed strategy to which there is no outcome-equivalent behavioral strategy.

(v) Why is Kuhn's theorem useful?

(b) Consider the "absent-minded driver" game. This is a one-player game without perfect recall where the player can be at one of two highway exits, but—when at an exit—cannot remember whether this is the first one or the second one. If he exists at the first exit, then he reaches the slum and gets a payoff of 0. If he stays on the highway and exists at the second exit, then he arrives home and gets a payoff of 4. If he continues on the highway also after the second exit, then he must stay overnight at a hotel, in which case he gets a payoff of 1. Discuss critically how to model behavior in this game. In particular, describe three different frameworks for analyzing the game, and derive the probability of exit for each of these frameworks.

Problem 3

Please read carefully "Asymmetric information bargaining problems with many agent" by Mailath and Postlewaite, in *Review of Economic Studies* **57**, 351–367 (1990), henceforth referred to as MP. This article allows agents' types to be drawn from a continuous distribution, F_i. In class, we instead focused on a discrete and binary type space, but note that our text book (pages 887–891) discusses how we easily can modify the model to consider a continuum of possible types.

(a) The model of MP is essentially presented on page 353. Based on this, can you describe the Vickrey-Clarke-Groves (VCG) mechanism?

(b) Regarding the possibility to implement efficient provision of public good, compare VCG and Theorem 2 in MP and explain why there is a difference.

(c) Theorem 2 in MP states that the inefficiency problem gets worse when n grows. What is the intuition for this?

(d) In class, we considered a binary public project "building a bridge" where each of two agents had valuation -2 or 3, with equal chance, of the project (costs

included). Requiring BB and IR, we showed in class that the probability for the bridge to be built had to be inefficiently small in order to satisfy the IC (incentive compatibility) constraint.

With these two valuations $\{-2, 3\}$, with equal chance for each agent, extend the model to $n = 4$ agents and compare the efficiency (i.e., the probability that the bridge will be built) to the case when $n = 2$.

(e) In the previous question, you should present an IC (incentive compatibility) constraint. By refererring to that IC constraint, please verify the claim on page 359 in MP, that: "The degree of inefficiency can be even more dramatic if there is some correlation in agents' valuations."