# *UNIVERSITY OF OSLO*
# *DEPARTMENT OF ECONOMICS*

Exam: **ECON3200/4200 – Microeconomics and Game Theory**

Date of exam: Friday, December 15, 2017 **Grades are given:** January 5, 2018

Time for exam: 14.30-17.30

The problem set covers 3 pages

Resources allowed:

- No written or printed resources – or calculator - is allowed (except if you have been granted use of a dictionary from the Faculty of Social Sciences)

The grades given: A-F, with A as the best and E as the weakest passing grade. F is fail.

The exam consists of 8 problems. They count as indicated. Start by reading through the whole exam, and make sure that you allocate time to answering questions you find easy. You can get a good grade even if there are problems or parts of problems that you do not have time to solve.

**Part 1. Microeconomics.**

*Problem 1 (6 %)*

Andrea's preferences over cars satisfy the following: a car is at least as desirable as another one if and only if it is at least as fast. Do Andrea's preferences over cars satisfy completeness, transitivity, reflexivity? Briefly justify your answers.

*Problem 2 (9 %)*

Barbara's preferences are represented by the utility function $u(x_1, x_2) = x_1 + x_2^2$. Is the first order condition of the utility maximization problem informative? Why? What is the share of her income that she would optimally spend on good 1, if income is $m = 100$ and prices are $p_1 = p_2 = 10$?

*Problem 3 (8 %)*

Ciro considers coffee and sugar as perfect complements with a fixed proportion (1 spoon of sugar for each cup of coffee). What do we know about the substitution and income effect resulting from a reduction in the price of sugar? Graphically sketch the Marshallian and Hicksian demand functions of Ciro.

*Problem 4 (15 %)*

Del Ta is a company that produces yoghurt y. The production involves two inputs, milk m and bacteria b. The production function is $f(m,b) = m^{\frac{1}{3}}b^{\frac{1}{3}}$. The firm is price-taker. Determine the cost and profit functions.

*Problem 5 (12 %)*

Emilia's vN-M utility function is $u(c_1, c_2, \pi_1, \pi_2) = \pi_1\sqrt{c_1} + \pi_2\sqrt{c_2}$, where $c_1$ and $c_2$ are monetary payoffs in states 1 and 2 and $\pi_1$ and $\pi_2$ are the probabilities associated to such states. Emilia is offered the possibility to take a gamble that pays either 36 or 64 with equal probability. What is Emilia's reservation price for this gamble? What is her risk premium?
Consider now a gamble that pays 4 times as much in each state (i.e., $4 * 36$ and $4 * 64$). Would Emilia be willing to pay 4 times as much for such a gamble? What index of risk aversion is constant under such behavior?

**Part 2. Game Theory.**

*Problem 6 (24 %)*

True or false? For each of the statements, if true, try to explain why it is true, and if false, try to explain why it is not true or provide a counterexample.

(a) The procedure of backward induction identifies a unique strategy profile in any finite extensive form game of perfect information.
(b) In the sequential bargaining game with an infinite number of periods (the Rubinstein model) the bargaining weights are divided equally between the players.
(c) In an infinitely repeated game, a strategy profile is a subgame perfect Nash equilibrium only if the players in each repetition play according a Nash equilibrium of the stage game.
(d) When constructing the Bayesian normal form of a static game of incomplete information we consider the situation from an ex ante perspective, where no player has yet received information of their own type.
(e) A dynamic Bayesian game models screening if the uninformed player moves before the informed player.
(f) In a perfect Bayesian equilibrium each player's strategy specifies optimal actions given his beliefs and the strategies of the other players, and the beliefs are always consistent with Bayes' rule.

*Problem 7 (10 %)*

Consider a normal form game with two players. Define the concepts of *best response* and *strictly dominated* strategy. How do they relate to each other? In particular, can a strategy that is strictly dominated be a best response to any belief about the behavior of the other player? And is a strategy that is not a best response to any belief about the behavior of the other player strictly dominated? Explain!

*Problem 8 (16 %)*

(a) Consider the following normal form game, where player 1's pure strategies are U and D, and player 2's strategies are L, M, N and R. Player 1's payoffs are listed first, player 2's second.

| | L | M | N | R |
|---|---|---|---|---|
| U | 1, 3 | 2, 2 | 3, 0 | 0, 1 |
| D | 0, 0 | 3, -1 | 2, 2 | 1, 1 |

What strategies are rationalizable? What strategy profiles are a Nash equilibrium?

(b) Assume now that player 1 first makes her choice of U or D, and that player 2 can observe player 1's choice before making his choice of L, M, N or R. The payoffs of the players as functions of their actions are the same as under part (a). What is the extensive form of this dynamic game? How many strategies does player 2 have in this extensive-form game? What strategy profiles are a subgame perfect Nash equilibrium?