

# University of Oslo

## Department of Economics

Exam: ECON3200/4200 – Microeconomics and game theory

Date of exam: Monday, November 23, 2015

Grades are given: December 15, 2015

Duration: 09:00 - 12:00

The problem set covers 3 pages including this page

Resources allowed: No resources allowed

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

**The exam consists of two parts. Each part consists of a number of subquestions. 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 parts of problems that you do not have time to solve. Please write clearly. Unreadable answers will get no points.**

## Part 1: Microeconomics

- Firm.

- A. A firm operates in a competitive market with the following production function:

$$\phi(z) = \frac{1}{4} \log z_1 + \frac{1}{2} \log z_2.$$

Determine the marginal rate of technical substitution between inputs and evaluate it at  $(z_1, z_2) = (1, 2)$ .

- B. Find the cost function of the firm.  
C. Check that the cost function satisfies Shephard's Lemma.

- Consumer.

- D. Ada has preferences over two (non-negative quantities of) commodities defined by:

$$(x_1, x_2) \succeq (z_1, z_2) \text{ if and only if } (x_1)^2 + (x_2)^2 \geq (z_1)^2 + (z_2)^2$$

Draw the no-worse-than-z-set for  $z = (z_1, z_2) = (1, 1)$

- E. Are these preferences complete?  
F. Continuous?  
G. Transitive?  
H. Convex?  
I. Do they satisfy greed?

- Uncertainty.

- J. Assume now that  $x_1$  and  $x_2$  are money in state 1 and money in state 2. States have probabilities  $\pi_1 = \pi_2 = \frac{1}{2}$ . Then, Ada's preferences (defined above) can be represented by the following expected utility function:

$$U(x_1, x_2) = \frac{1}{2}(x_1)^2 + \frac{1}{2}(x_2)^2.$$

What is the risk premium at  $(x_1, x_2) = (0, 2)$ ?

- K. Compute the index of relative risk aversion and provide an interpretation.

## Part 2: Game Theory – Escaping the Prisoners’ Dilemma

Consider the following Prisoners' dilemma (PD) game, where in each cell the first number is P1's payoff and the second number is P2's payoff.

P.1↓ P.2→	Defect	Cooperate
Defect	1,1	4,0
Cooperate	0,4	3,3

- A. Define or write in your own words what a Nash Equilibrium (NE) is.
- B. What is/are the NE in the game?
- C. Define or write in your own words what an efficient strategy profile is.
- D. Which strategy profiles are efficient?
- E. Now suppose a social norm is imposed. This norm is very specific and says: “Though shalt not defect against a cooperating player. More precisely, a player that defects against a cooperating player (breaks this norm) shalt be punished by a payoff-reduction of two units”. Write out the normal form of this game and motivate the payoffs.
- F. What is/are the NE in this new game with a norm?
- G. Now suppose that in the game with a norm it is decided that P1 moves first and that P2 moves second after having observed the action of P1. Write out the extensive form of this dynamic game.
- H. Find the unique Subgame Perfect Nash Equilibrium by backward induction.
- I. Discuss briefly how and why the three games (PD, PD with norm and sequential PD with norm) do or do not differ.