UNIVERSITY OF OSLO
DEPARTMENT OF ECONOMICS

Exam: **ECON3200/4200 – Microeconomics and game theory**

Date of exam: Tuesday, November 29, 2011 **Grades are given: December 22, 2011**

Time for exam: 2:30 p.m. – 5:30 p.m.

The problem set covers 3 pages

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 four 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 parts of problems that you do not have time to solve.

Problem 1 (30 %)

There are two goods in the economy, and they can be traded in a competitive market at prices $\mathbf{p} = (p_1, p_2)$. A consumer initially owns an amount $R_i \geq 0$ of good $i = 1, 2$ and has in addition a cash income of $\bar{y} \geq 0$. The consumer has positive resources, that is, at least one of $R_1, R_2, \bar{y}$ is strictly positive. The consumer maximizes a utility function $U(x_1, x_2)$. The optimal consumption of good *i* is denoted x_i^*.

(a) Write down an expression for the total income at the consumer's disposal. Formulate the consumer's maximization problem and deduce the first-order conditions for optimum.

(b) Define the concepts *ordinary* and *compensated* demand function.

(c) Express x_i^* by means of the ordinary demand function.

In this case, the analogy of the Slutsky equation looks like this:

$$\frac{dx_i^*}{dp_j} = H_j^i(\mathbf{p}, \upsilon) - \left[x_j^* - R_j\right] D_y^i(\mathbf{p}, y). \tag{1}$$

Here $D^i(\mathbf{p}, y)$ is the ordinary and $H^i(\mathbf{p}, \upsilon)$ the compensated demand function for good *i*, subscript *j* denotes differentiation with respect to the price of good *j*, and subscript *y* denotes differentiation with respect to total income.

(d) Explain the terms in equation (1). In particular, explain how the terms relate to the concepts *substitution effect* and *income effect*.

(e) Can anything be said about the sign of $\frac{dx_i^*}{dp_j}$ and $H_j^i(\mathbf{p},\upsilon)$? Answer this question both for $i = j$ and $i \neq j$.

(f) Then assume that the utility function is of the Cobb-Douglas type, that is,

$$U(x_1, x_2) = \alpha_1 \log x_1 + \alpha_2 \log x_2$$

for positive parameters α_i with $\alpha_1 + \alpha_2 = 1$. Compute x_i^*.

Problem 2 (20 %)

(a) Define the concept *risk aversion*.

(b) If a risk-averse individual's decisions can be described as expected-utility maximization, what are the properties of the (von Neumann-Morgenstern) utility function?

(c) Define and explain the concepts
- (i) certainty equivalent
- (ii) risk premium
- (iii) index of absolute risk aversion
- (iv) index of relative risk aversion

(d) Assume that the utility function is given by

$$u(x) = -e^{-\lambda x}$$

where λ is a positive constant. Compute the indices of absolute and relative risk aversion.

Problem 3 (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 4 (40 %)

Consider a strategic situation between player 1 and player 2. Player 1 can choose either U or D. Player 2 can be of two types, S or W, and can choose either L or R if his type is S and choose either L′ or R′ if his type is W. The players' payoffs depending on their actions and player 2’s type are shown below.

S

	L	R
U	6, 6	2, 4
D	3, 4	3, 2

W

	L′	R′
U	2, 2	0, 0
D	3, 0	7, 2

a) Assume first that the type of player 2 is known by both players and that they make their choices simultaneously. For each type of player 2, determine the set of (pure) rationalizable strategies for each player, and the set of pure-strategy Nash equilibria.
b) Assume next that only player 2 knows his own type, while player 1 thinks that the two types of player 2 are equally likely. Maintain the assumption that choices are made simultaneously. Model this situation in an ex ante perspective by specifying the Bayesian normal form.
c) For the Bayesian normal form found in part (b), determine the set of (pure) rationalizable strategies for each player, and the set of pure-strategy and/or mixed-strategy Nash equilibria.
d) Assume finally that player 1 acts before player 2, but without knowing player 2’s type, and that player 1's choice of U or D can be observed by player 2 before he makes his choice of L or R. Show that there is a unique subgame perfect Nash equilibrium.

Please do not forget the periodic course evaluation for ECON3200/4200, which you will find on the website for the course. The deadline is December 20.