LuTK, OyKKK, KaTK, TTK, TST ja BMTK (Linnanmaan tentit)
SCI, OBS, OMS, TECH, ITEE and BMM (Linnanmaa campus)

UNIVERSITY OF OULU

YLIOPISTOTENTTI - UNIVERSITY EXAM

Opiskelijan nimi / Student name:	Opiskelijanumero / Student number:

Opettaja täyttää / Lecturer fills in:

Opintojakson koodi and nimi / The code and the name of the course:

Koodi / Code 721342S

Tentin nimi / Exam name: Game Theory

Tiedekunta / Faculty: OBS

Tentin pvm / Date of exam: 30.5.2016	**Tentin kesto tunteina / Exam in hours: 4**
Tentin nro / No. of the exam: Tentti	**Opintopistemäärä / Credit units: 6**
Tentaattori(t) / Examiner(s): **Marja-Liisa Halko**	**Sisäinen postios. / Internal address:** **6 OyKKK**

Sallitut apuvälineet / The devices allowed in the exam:

☒ Nelilaskin / Standard calculator
☐ Funktiolaskin / Scientific calculator
☐ Ohjelmoitava laskin / Programmable calculator

☐ Muu materiaali, tarkennettu alla / Other material, specified below:

Tenttiin vastaaminen / Please answer the questions:
☒ Suomeksi / in Finnish ☒ Englanniksi / in English

Kysymyspaperi on palautettava / Paper with exam questions must be returned:
☒ Kyllä / Yes ☐ Ei / No

Game Theory (721342S), University of Oulu

Final exam 30.5.2016

Answer all the questions (1-5). NOTE! As you will answer the question 5 in this question paper, please write below also your name and your student identification number and return this paper with your answers.

Name: ______________________________

Student id. number: ______________________________

1. Consider the normal form game below. Solve all Nash equilibria of the game (both pure strategy and mixed strategy equilibria). (6 points)

		Player 2: A	Player 2: B
Player 1	A	1,4	2,0
	B	0,8	3,9

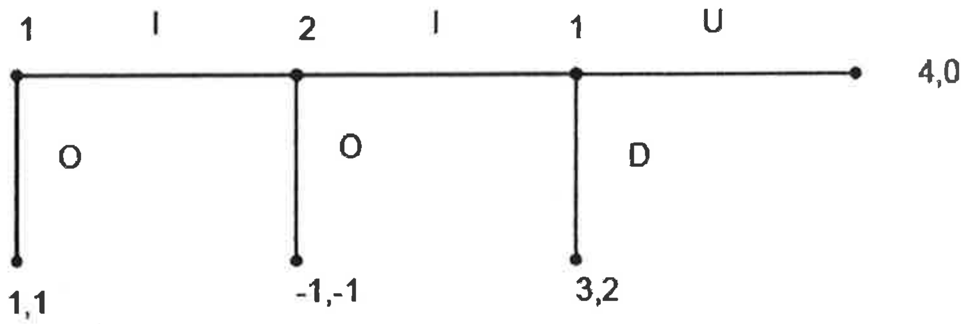
2. Consider the two-player game below:

		Player 2: L	Player 2: C	Player 2: R
Player 1	U	5,1	1,4	1,0
	M	3,2	0,0	3,5
	D	4,3	4,4	0,3

(a) Show that Player 2's mixed strategy $\sigma_2 = \left(0, \frac{1}{2}, \frac{1}{2}\right)$ strongly dominates Player 2's strategy L. (3 points)

(b) In addition, show that Player 2 has also other mixes strategies that strongly dominate the strategy L, and that actually, there exists an infinite number of such mixed strategies. (3 points)

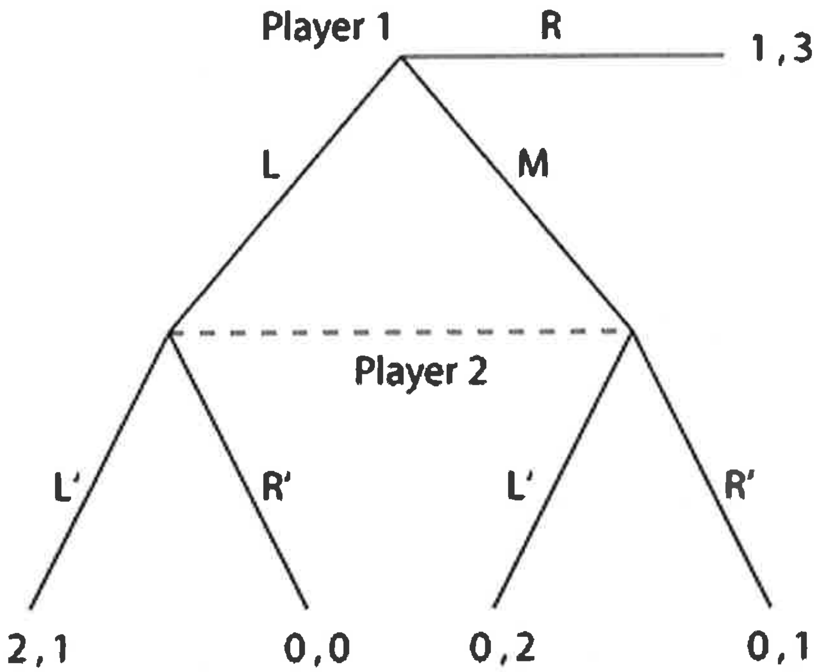
3. Consider the following extensive form game:



(a) Write the game in normal form and solve its Nash equilibria. (3 points)

(b) Solve the subgame perfect equilibria of the game. Does the game have Nash equilibria that are not subgame perfect equilibria? (3 points)

4. Write the game below in normal form and solve its Nash equilibria (in pure strategies). (6 points)



5. Two persons are involved in a dispute. Person 1 does not know whether person 2 is weak or strong; she assigns probability α to person 2's being strong. Person 2 is fully informed. Each person can either fight or yield. Both will get a payoff of 0 if they yield (regardless of the other person's action) and a payoff of 1 if she fights and her opponent yields. If both players fight, then their payoffs are (-1, 1), if person 2 is strong, and (1,-1) if person 2 is weak.

(a) Formulate the decision-making situation as a Bayesian game, that is, write the game matrices that describe the situation. (4 points)

(b) In the following, there are six statements relating to the solution of the problem. Indicate whether these statements are true of false. **For every correct answer you will get two (2) points and for every wrong answer you will get minus one point (-1). If you do not answer anything, you will get zero points. Note! However, the lower limit of your points is zero points.** (max 12 points)

Write first the Bayesian normal form of the game. Let's first write the strategies of the players.

STATEMENT 1: Person 1 has four strategies, because she does not know, whether person 2 is weak of strong.

☐ True ☐ False

STATEMENT 2: Person 2 has four strategies, because she knows whether she herself is weak or strong.

☐ True ☐ False

Next we add the Bayesian normal form the payoffs of the players.

STATEMENT 3: Both person 1's and person 2's payoffs depend on the probability α.

☐ True ☐ False

STATEMENT 4: If both players always fight, they both get payoff $1 - 2\alpha$.

☐ True ☐ False

Next we use the Bayesian normal form to solve the Nash equilibria of the game (or bayesian Nash equilibria). In the equilibrium, neither of the players wants to deviate from the equilibrium strategy and choose some other strategy.

STATEMENT 5: If $> \frac{1}{4}$, then, in the equilibrium, person 1 always yields and person 2 always fights.

☐ True ☐ False

STATEMENT 6: If $\alpha < \frac{1}{2}$, then, in the equilibrium, Person 1 always fights and Person 2 fights, when she is strong, and yields, when she is weak.

☐ True ☐ False