UNIVERSITY OF WARWICK

Summer Examinations 2017/18

Microeconomics 2

Time Allowed: 3 hours.

Answer **ALL FOUR** questions in **Section A** (18 marks each), and **ONE** question from **Section B** (28 marks). Answer Section A questions in one booklet and Section B questions in a separate booklet.

Approved pocket calculators are allowed.

Read carefully the instructions on the answer book provided and make sure that the particulars required are entered on each answer book. If you answer more questions than are required and do not indicate which answers should be ignored, we will mark the requisite number of answers in the order in which they appear in the answer book(s): answers beyond that number will not be considered.

Section A: Answer ALL FOUR questions

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1. (Uncertainty)

An individual has a utility function u(x) where x denotes uncertain income.

(a) Write down expressions that capture the individual's degree of absolute and relative risk aversion respectively**. (2 marks)**

(b) If the person can choose between a risky asset and a safe asset, describe in brief what the absolute and relative risk aversion expressions suggest about the amount invested in the risky asset as income x increases. **(2 marks)**

(c) John von Neumann and Oskar Morgenstern proved that the utility of a lottery (in this case uncertain income) is equal to the statistical expectation of the individual's valuations of the outcomes of the lottery. List and briefly describe the axioms that are required for the proof. **(8 marks)**

(d) If u(x) = ln x, how does the individual's attitude towards risk vary in x? Explain your finding. **(6 marks)**

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2. (Pareto Efficiency and Exchange)

Consider a two-person (A,B), two-good (x,y) pure exchange economy in which there is no production and the two individuals i=A,B have fixed endowments of the goods $\hat{x}_i > 0$ and $\hat{y}_i > 0$.

(a) Assuming strictly quasi-concave utility functions $u_i(x_i, y_i)$, illustrate in an Edgeworth Box why, for a given set of prices p_x and p_y, each individual would have unique demands for each good x and y. **(4 marks)**

(b) In the Edgeworth Box drawn in (a), indicate what allocations of the total endowments satisfy Pareto efficiency. **(4 marks)**

(c) If for some allocation (x*,y*) the absolute value of individual B's marginal rate of substitution between goods x and y *exceeds* the absolute value of individual A's marginal rate of substitution between x and y, and both individuals consume positive amounts of both x and y, describe why one or both can do better by trading. Describe qualitatively the direction of trading that would occur. **(4 marks)**

(d) Suppose instead that x and y are produced in the economy using capital K and labour L, where the total quantity of inputs is fixed. Assume the consumers face competitive prices p_x and p_y for x and y respectively and choose demands compatible with efficiency in consumption. Show diagrammatically with reference to a production possibility frontier that efficiency overall occurs when the marginal rate of transformation (MRT) between x and y equals the common marginal rate of substitution (MRS) in consumption. Explain why efficiency does not hold in the economy if this condition is not satisfied. **(6 marks)**

3. (Game Theory)

Consider the following two-person, two-action, symmetric, simultaneous move game shown in strategic or normal form below:

		Player 2	
		L	*R*
Player 1	*T*	*a*,*a*	*c*,*b*
	B	*b*,*c*	*d*,*d*

(a) Why is this game one of imperfect information? Draw an extensive form version of the game in which player 2 moves *as if* first. **(4 marks)**

(b) Explain why the game is referred to as 'symmetric'. **(2 marks)**

 (Question 3 continued overleaf)

(c) If (B,R) is the dominant solvable outcome, what does this imply about the relative magnitudes of the payoffs in the game? **(2 marks)**

(d) Assuming $a \geq d > b \geq c$, find the pure strategy Nash equilibria in the game. **(2 marks)**

(e) Suppose the two players play a multi-stage game. Stage 1 is the above normal form game where $b > a > d > c$. Stage 2 is another normal form game:

		Player 2	
		L	R
Player 1	T	e,e	g,f
	B	f,g	h,h

where $e > h > f \geq g$. Assuming the players have a common discount factor $0 < \delta < 1$, is it possible a subgame perfect equilibrium in pure strategies for the multi-stage game could feature play in stage 1 incompatible with Nash behavior in the one-shot equivalent of the stage 1 game? Explain your answer. **(8 marks)**

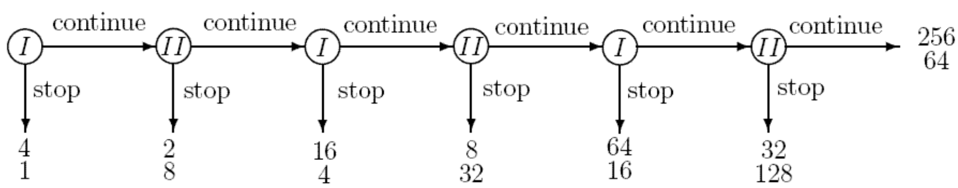
4. (Game Theory)

Consider any finite extensive form game of complete information.

(a) Use the Chain-Store game to illustrate why some Nash equilibria imply strategies that may not be credible. **(3 marks)**

(b) What requirement is applied in such games to eliminate Nash equilibria that imply irrational behaviour off the equilibrium path? Briefly explain your answer. **(4 marks)**

(c) Consider the setting where two individuals play the following game.



Player I moves first and can choose action ‘stop’ or ‘continue’. If player I chooses stop, the game ends and the payoffs are 4 to player I and 1 to player II. If player I chooses continue, player II moves and can choose ‘stop’ and ‘continue’. The payoffs are shown in the diagram above and the game can potentially continue until player II chooses stop or continue in the final move. Rational players know that the highest aggregate payoff is achieved by playing continue everywhere. Rational players will therefore choose the action continue in every subgame. Is this correct? Briefly explain your answer. **(5 marks)**

(d) Consider the following scenario. There is a line of $n>1$ cannibals $C_1,\ldots,C_n$ all facing to the right and at the end of the line is a person called Joe, denoted J. The line is ordered $C_1,\ldots,C_n$,J, where C_1 is furthest to the left and J furthest to the right. Each cannibal is only able to eat the cannibal in front of them, but only if the cannibal in front of them has also eaten. The cannibal directly behind Joe is able to eat Joe. Assume each cannibal has the following preference relations:

(i) A cannibal prefers “not eating” over “being eaten” but otherwise

(ii) A cannibal prefers to “eat”

Will Joe be eaten? Explain your answer. **(6 marks)**

Section B: Answer ONE question.
Please use a separate booklet.

5. (Public Goods)

Answer the following:

(a) Describe the two characteristics of a pure public good**. (6 marks)**

(b) Describe and state the Samuelson Condition associated with efficiency in the presence of a pure public good. **(6 marks)**

(c) Consider an economy with five individuals i=1,…,5 where each has the following utility function:

$$u_i(G,x_i)=x_i-\frac{1}{2}(\alpha_i-G)^2$$

where G denotes a public good, x_i is the quantity of a private good consumed by person i and α_i is a parameter reflecting person i’s tastes for the public good. What form of utility function does each person have and what does it imply about the private good x? **(2 marks)** What is the value of each person’s marginal rate of substitution? **(4 marks)**

(d) If the marginal cost of G is 40 and the preferences of the five individuals are:

$$\alpha_1=30, \alpha_2=27, \alpha_3=24, \alpha_4=21, \alpha_5=18,$$

compute the value for the optimum quantity G^* of the public good. **(4 marks)**

 (Question 5 continued overleaf)

(e) Assuming each individual has an endowment $\hat{x}_i$ of the private good, find a set of personalized prices p_i that ensure efficient supply of the public good. **(5 marks)** What is the name given to such prices? **(1 mark)**

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6. (General Equilibrium)

Consider an economy with two types of consumer (A,B), two outputs (X,Y) and two inputs (K,L). Assume that the economy is endowed with $\bar{K},\bar{L}$ units of capital and labour respectively. Production technologies are assumed to be continuously differentiable functions with positive but diminishing marginal products in own inputs:
$X = F^X(L_X, K_X), Y = F^Y(L_Y, K_Y)$

(a) Show diagrammatically or by application of algebra the conditions required to ensure efficiency in consumption. **(6 marks)**

(b) Show diagrammatically or by application of algebra the conditions required to ensure efficiency in production. **(6 marks)**

(c) Show diagrammatically or by application of algebra that the slope of the production possibility frontier is equal to the ratio of the marginal products for each good X and Y. **(6 marks)**

(d) Describe in words the first fundamental theorem of welfare economics. **(4 marks)**

(e) Show diagrammatically or by application of algebra the first fundamental theorem of welfare economics for the economy outlined above. **(6 marks)**

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7. (Cooperative Games)

Answer the following:

(a) In n-person cooperative games for $n \geq 3$ the focus of analysis is on the payoffs associated with different possible coalitions. Explain what the following assumption about the characteristic functions for coalitions A and B means and what it is called:

$$v(\mathrm{A}) \cup v(B) \geq v(A) + v(B) \quad \text{if} \quad A \cap B = \varnothing$$

(6 marks)

(b) Let the vector x=(x_1,…,x_n) be an allocation in an n-person cooperative game that is an *imputation*. What conditions are satisfied by the vector x? Provide a brief explanation. **(6 marks)**

(Question 7 continued overleaf)

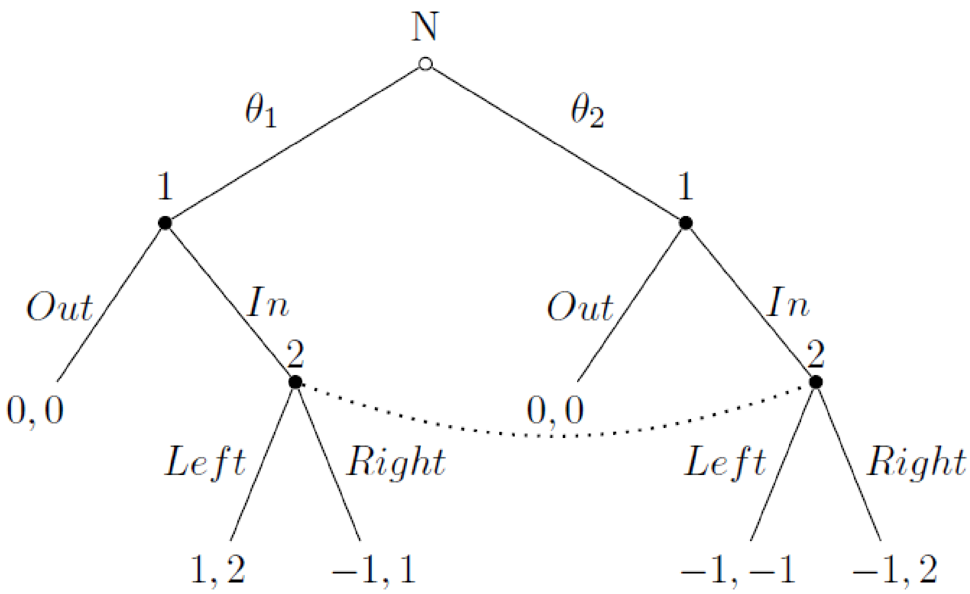
(c) Consider a two-person cooperative bargaining game in which the players can choose an allocation (*u*,*v*) within the feasible set *S*, i.e. $(u,v) \in S$. The players have the option to choose $(\bar{u},\bar{v})$ by unilateral action (alternatively, this vector represents the disagreement point). Set out and explain the axioms Nash showed as necessary for a unique solution

$$\varphi(S,\bar{u},\bar{v}) = (u^*,v^*)$$

to the bargaining problem. In your answer, make clear what form the function $\varphi(S,\bar{u},\bar{v})$ takes. **(16 marks)**

8. (Extensive Form Game)

Consider the following incomplete information game in extensive form in which N represents nature and player 1 has two types θ_1 and θ_2. It is assumed there is a common prior (1/2,1/2) about player 1's hidden type.



(a) Why is *Perfect Bayesian Equilibrium* an appropriate solution concept for this game? Explain the key properties of this solution concept. **(6 marks)**

(b) Find all the pure strategy *Perfect Bayesian Equilibria*. **(10 marks)**

(c) Which of the solutions you have identified in part (b) survive the Cho-Kreps Intuitive Criterion? **(8 marks)**

(d) What makes solutions that survive the Intuitive Criterion more appealing? **(4 marks)**