UNIVERSITY OF CAMBRIDGE

ECT1
ECONOMICS TRIPOS PART I

Thursday 6 June 2019 9:00am – 12:00pm

Paper 1

MICROECONOMICS

Answer **ALL SIX** questions from Section A and **TWO** questions from Section B.

Section A and B will each carry 50% of the total marks for this paper.
Each question within each section will carry equal weight.

Write your **candidate number** (not your name) on the cover of each booklet.

Candidates are asked to note that there may be a reduction in marks for scripts with illegible handwriting.

If you identify an error in this paper, please alert the **Invigilator**, who will notify the **Examiner**. A **general** announcement will be made if the error is validated.

STATIONERY REQUIREMENTS
20 Page booklet x 1
Rough work pads
Tags

SPECIAL REQUIREMENTS TO BE SUPPLIED FOR THIS EXAMINATION
Calculator – students are permitted to bring an approved calculator.

You may not start to read the questions printed on the subsequent pages of this question paper until instructed that you may do so by the Invigilator.

SECTION A *Answer all six questions from this Section.*

1. A consumer's preferences over three goods are given by the utility function

$$U(a, b, c) = a + b + \ln c$$

Suppose originally her income is 10 and she faces prices $(p_a, p_b, p_c) = (3, 1, 2)$. After a policy change, her new income is 9 and the new prices are $(2, 1, 1)$.

(a) What are the consumer's optimal choices before and after the policy?

(b) Evaluate the consumer's surplus, the equivalent variation, and the compensating variation associated with the policy change.

2. Let (g, t) stand for a gin-and-tonic cocktail which contains $g > 0$ units of gin and $t > 0$ units of tonic. Homer's ideal ratio of gin to tonic is exactly $1/3$. When comparing two cocktails, Homer prefers the cocktail whose ratio of gin to tonic is closer to $1/3$. Given two cocktails whose ratios of gin to tonic are equally far from $1/3$, Homer ranks them according to their volumes: the larger the volume, the better; if equal volumes, then they are equally good.

(a) Determine whether Homer's preferences over cocktails are rational or not, and justify your answer.

(b) Determine whether Homer's preferences over cocktails are strictly convex or not, and justify your answer.

3. (a) Explain what is meant by 'price elasticity of demand', and, given demand Q as a function of price p, derive a formal expression to capture price elasticity of demand.

(b) Show that a monopolist's choice of price will never be in the inelastic section of the demand curve.

4. Two people, A and B, have utility functions

$$U_A(m_A, c_A) = m_A + c_A^{\alpha}$$

and

$$U_B(m_B, c_B) = m_B + c_B^{\beta}$$

where, for $i = A, B$, m_i is i's money wealth in pounds, c_i is i's consumption of cake and α and β are constants such that $0 < \alpha < 1$ and $0 < \beta < 1$. Initially A and B respectively have wealth of M_A and M_B, but no cake. However, cake can be produced at a constant marginal cost of k pounds per unit. Assume that M_A and M_B are large.

(a) Find a Pareto-efficient production and allocation plan.

(b) Is it the only Pareto-efficient plan? Explain.

5. 'According to the Coase Theorem, as long as property rights are well-defined, the level of an externality will be Pareto-efficient because all parties will face the same relative prices'. Comment.

6. In an economy with two agents there are two goods, one private (Y) and one public (G). Initially there are 10 units of Y and no G but G can be produced via production function $g = \sqrt{2y}$ where y is the amount of good Y used as input and g is the output of good G.

(a) Sketch the frontier of the feasible set of pairs (g, y) available in this economy. Find the marginal rate of transformation of private into public good, as a function of g.

(b) Suppose that the two agents each consume 4 units of Y and the remainder of good Y is used to produce the public good. If each agent then has a marginal rate of substitution of 5/4, is this allocation Pareto-efficient? Explain why or why not.

SECTION B *Answer two questions from this Section.*

7. (a) A single-product firm with constant returns to scale technology operates in a competitive market. Suppose the firm offers to some of its customers a special discount of d per unit, and as a result, the total demand by these customers changes from x to x'. How much does this special discount cost the firm in total?

   (b) The above firm would like to reward one of its employees who is a keen consumer of the firm's product. One option is to offer the employee a discount d on the unit price of the product. The other option is to simply give the employee the cash amount C. The employee is indifferent between these two options. Which reward would cost the firm less? Explain carefully.

8. Suppose a profit-maximising monopolist with cost function $c(q) = 20q$ is facing two consumers whose demands for the monopolist's product are given by $D_1(p) = 120 - p$ and $D_2(p) = 80 - 2p$, respectively.

   (a) Assume the monopolist is not able to price discriminate. Draw, carefully, the aggregate demand curve, and illustrate the consumers' surplus, the producer's surplus, and the deadweight loss associated with the monopolist's optimal choice.

   (b) What is *first* degree price discrimination? What are the consumers' surplus, the producer's surplus, and the deadweight loss if the monopolist can engage in first degree price discrimination?

   (c) What is *second* degree price discrimination? What are the consumers' surplus, the producer's surplus, and the deadweight loss if the monopolist can engage in second degree price discrimination?

9. (a) What is the 'rational choice framework'? What makes this framework potentially useful and what are the key points in using this approach successfully?

   (b) Xavi is one of four siblings. He cares about his consumption x: the more the better. But he also cares about his siblings' consumption: the higher his siblings' average consumption a, the better. Specifically, his marginal rate of substitution between x and a is

$$MRS_{x,a} = \frac{2a}{x}$$

   If Xavi has income 18, and his siblings have none, how much money would Xavi choose to transfer to his siblings? How does Xavi's choice compare with that of a rational decision maker?

10. There are two individuals (A and B) in a pure exchange economy with two goods, x and y. The utility function of person i ($i = A, B$) if they consume (x_i, y_i) is $U(x_i, y_i) = \sqrt{x_i} + y_i$. The endowment of A is 4 units of x and 1 of y; B's endowment is 2 units of x and 3 of y.

(a) Draw the Edgeworth Box and identify the contract curve graphically and algebraically.

(b) Find the individuals' demand functions.

(c) Find the competitive equilibrium prices and allocations.

(d) Verify that Walras' Law holds in this economy, for prices which give an interior solution.

(e) If the endowments were instead $(4, 4)$ for A and $(2, 0)$ for B, what would the equilibrium prices and allocation be? Argue graphically.

11. A Robinson Crusoe economy has a constant returns production function $y = kL$, where y is quantity of output, L is labour input and $k > 0$ is a constant. Robinson's maximum labour time is T and he has no endowment of the output good. His utility function is

$$U(y, \ell) = \frac{2}{3}\ln(y) + \frac{1}{3}\ln(\ell)$$

where y is consumption of the output good, ℓ is the amount of leisure and $\ln(\cdot)$ is the natural logarithm.

(a) Sketch the production function and indifference curves and find Robinson's optimal plan.

(b) If all production takes place in a firm, the firm makes profit π and Robinson owns the firm, write his budget constraint and find his consumption demand, leisure demand and labour supply functions, as a function of wage w and π, normalizing the output price to 1.

(c) Find the firm's maximum profit in competitive equilibrium and solve for the equilibrium prices, labour input and consumption. Explain your reasoning carefully.

(d) Discuss the relationship between your answer to (a) and your answer to (c).

(e) Now suppose that the marginal product of labour is zero for $L < a$ and k for $L \geq a$, where $a < T$. Sketch the production function and find Robinson's optimal plan. Does the conclusion of the Second Welfare Theorem apply to this economy? Explain your answer.

12. A large population of commuters travel each day from one city to another. They can travel either by train or by car. The train takes a fixed time k regardless of how many people take the train, but a car journey takes bn minutes, where n is the number of commuters choosing to travel by car (treat n as a continuous variable) and $b > 0$ is a constant. Commuters are all identical and any commuter i has utility function $U(m_i, \tau_i) = m_i - \sqrt{\tau_i}$ where m_i is i's money wealth and τ_i is i's commuting time.

(a) Find the number of people who choose the car if both modes of transport are free.

(b) Find the Pareto-efficient number of drivers and explain how this is a Pareto-improvement over your solution to (a).

(c) Find a tax on driving which will cause the number of drivers to equal the Pareto-efficient number (with the train continuing to be free).

(d) Find the outcome and the utilities of the commuters if the government returns the tax revenue, in equal amounts, (i) to the car drivers, but not the train passengers, and (ii) to all commuters.

(e) Discuss your results and the merits of such tax-and-rebate schemes.

END OF PAPER