Version JKR/1

EGT2
ENGINEERING TRIPOS PART IIA

Monday 6 May 2025 9.30 to 11.10

Module 3E1

BUSINESS ECONOMICS

*Answer not more than **two** questions.*

All questions carry the same number of marks.

*The **approximate** percentage of marks allocated to each part of a question is indicated in the right margin.*

*Write your candidate number **not** your name on the cover sheet.*

STATIONERY REQUIREMENTS
Single-sided script paper.

SPECIAL REQUIREMENTS TO BE SUPPLIED FOR THIS EXAM
CUED approved calculator allowed.

10 minutes reading time is allowed for this paper at the start of the exam.

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

You may not remove any stationery from the Examination Room.

1 A jazz-club owner has students as well as other adults as customers. The demand for drinks by a typical student is $Q^S = 18 - 3P$. The demand for drinks for other adults is $Q^A = 10 - 2P$. The marginal cost of each drink is £2. Provide your reasoning/calculations when answering the questions below.

(a) What price will the club owner set if it is not possible to differentiate between students and other adults? Compute total profit. [20%]

Compute aggregate demand by adding both groups' demand curves. Great answers will recognize that this leads to a kink in the aggregate demand curve where for sufficiently high prices ($6 \geq P \geq 5$) only students will demand club entry and adults enter the market once the price is low enough ($5 \geq P$). Great answers will either graphically or algebraically argue that it is optimal to price such that both groups participate in the market. The aggregate demand curve can then be inverted and used in an MR = MC calculation to yield optimal price of £3.8 and resulting quantity demanded of 9. Total profit can then be calculated as total revenue minus total costs.

(b) If the club owner can charge a different price to students and to other adults, what prices should it charge? Compute total profit. [20%]

Compute prices and quantities under 3rd degree price discrimination by equating MR to MC in each market separately, yielding pairs (P, Q) for students (£4, 6) and adults (£3.5, 3). Total profit can then be calculated as total revenue minus total costs.

(c) Assuming the club owner can determine who among customers is a student and who is not and would like to sell to each group by offering a number of drink tokens for a cover charge (a cover charge is a fixed fee paid for admission to a club, a bar or a restaurant), what will the cover charge and number of tokens be for students? For other adults? Compute total profit. [15%]

Apply block pricing strategy to determine the package for each type. This means setting a block price such that the club owner can cover total costs and extract all consumer surplus that would have occurred in an efficient scenario (setting P = MC) for each market separately. Optimal packages (P, Q) are students (£48, 12) and other adults (£21, 6).

(d) The club owner realises that it is not possible to distinguish students from other adults coming to the club. If the club owner would like to offer the same number of tokens found in part (c), what cover charges will it charge? [20%]

Apply 2nd degree price discrimination to determine the package for each type. Offering the same packages as in c) would lead to students self-selecting into the adult package (£21, 6) given this yields a surplus of £9 for them. To avoid this, the club owner reduces the price of the student package by the same amount to ensure they select to purchase the larger package. Prices of the adult package remain unchanged, so the owner offers combinations (P, Q) of (£21, 6), (£39, 12).

(e) Comment on the feasibility and welfare consequences of the different pricing strategies proposed. [25%]

An opportunity to discuss how the different price strategies can be implemented (pre-conditions) and how they affect CS, PS and TS.

2 Answer the two questions below.

(a) Global supply chains have been affected by the prospects of higher tariffs on goods and services. Assuming a perfectly competitive model, explain the effect of tariffs on price, quantity and welfare. Who are more likely to bear the burden of higher tariffs, consumers or producers? Explain. Include diagrams in your answer to illustrate the effect of tariffs. [50%]

Answers would include a supply and demand diagram showing the effect of a tax (eg shift in supply) and how it creates a wedge between the price of the buyer and price of the seller. Quantity decreases in the new equilibrium. Better answers would also show the welfare consequences of the tax and the inefficiency brought about the regulation. Great answers would demonstrate the connection between elasticities and who bears the burden of the tax and discuss how externalities may play a role.

(b) Consider the following differentiated Bertrand game below and justify your answers.

		Firm 2	
		Charge $6	Charge $4
Firm 1	Charge $6	4, 6	3, 2
	Charge $4	6, 1	5, 3

(ii) Find all Nash Equilibria in pure and mixed strategies. [15%]

NE is (4,4) with payoffs (5,3). The prices that maximize combined returns are $6 for both firms. A mixed strategy solution where Firm 1 puts positive weight on both prices is not a possible Nash equilibrium in the case because Firm 1 has a dominant strategy ($4) and thus will choose its dominant strategy with probability 1. In other words, regardless of what Firm 1 believes about the probability that Firm 2 will choose $6 versus $4, Firm 1 will always choose $4 with probability 1.

(ii) What would happen if the game is played 3 times? Is played repeatedly over time? [20%]

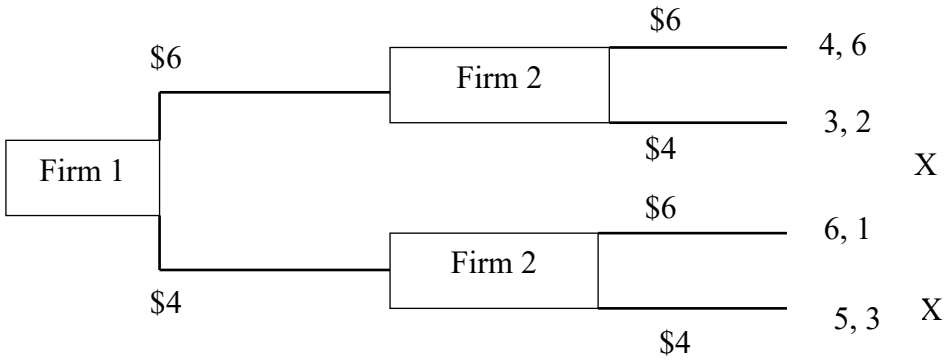
In a repeated prisoners' dilemma with an infinite number of repetitions, tit-for-tat strategies are generally effective at maximizing joint welfare for the two firms. It is tempting to conclude that the same result will hold in this game. The reason why tit-for-tat strategies do not maximize joint welfare in this game (i.e., where each firm chooses $6) is that this game is not a prisoners' dilemma. Indeed, when moving from an equilibrium where both firms charge $4 to one where both firms charge $6 it can be seen that Firm 1 is worse off. Because of this dominant strategy there is no form of future punishment that Firm 2 can use to ensure Firm 1 chooses $6 rather than $4. Similarly, given that Firm 1 will choose $4 in all rounds there is no form of future punishment that Firm 1 can use to ensure Firm 2 chooses $6 rather than $4.

If the game will be played exactly 3 times and this is common knowledge, the Nash equilibrium strategies are *each firm will choose $4 (i.e., the same outcome as in the single-round game). In a repeated prisoners' dilemma moving to a game with a finite number of rounds (e.g., 3) from a game with an infinite number of rounds implies that the outcome which maximizes joint profits is not possible due to backward unraveling. In this question the backward unravelling argument is not used to justify the answer*

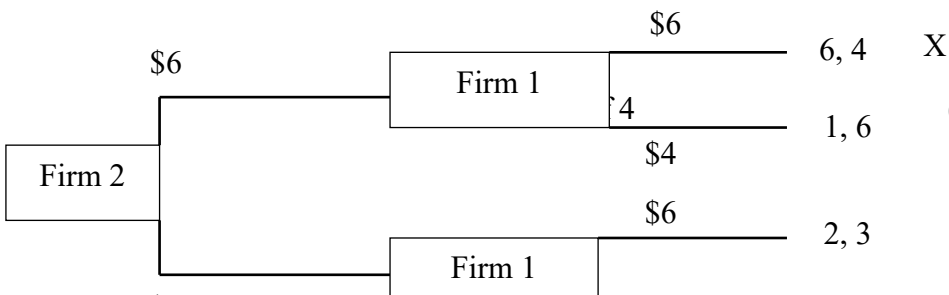
because the equilibrium is the same regardless of whether the number of rounds is finite or infinite,

(iii) Now suppose that the payoffs shown are for a sequential game that will be played just once. Is there a first mover advantage in this game? Explain and include diagram(s). [15%]

We solve this sequential game by putting an X on the branches that would not be chosen by Firm 2. With the elimination of these branches, Firm 1 knows that it will earn a payoff of 4 if it chooses \$6 (upper branch) and will earn a payoff of 5 if it chooses \$4 (lower branch). Choosing \$4 results in the highest payoff and so each firm choosing \$4 is the subgame perfect (sequential Nash) equilibrium.



Using procedures similar to those described above, it can be seen in the extensive form game below that with Firm 2 as the leader and Firm 1 as the follower we still obtain both firms choosing \$4 as the subgame perfect (sequential Nash) equilibrium. Thus, there is no first mover advantage.



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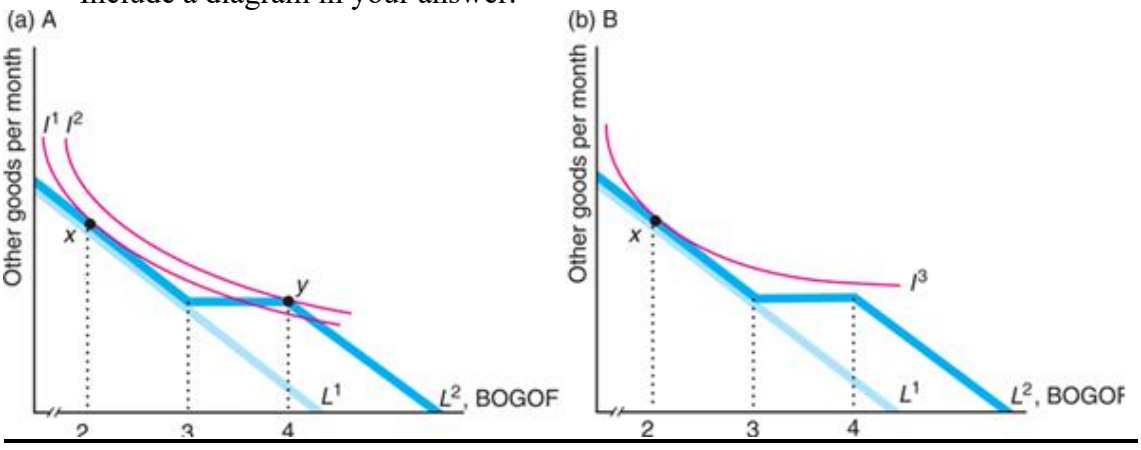
X

In general, when one or both players in a two-player game has a dominant strategy there is no first mover advantage. This is because the sequence of play will not affect the choice of strategy for the firm with the dominant strategy and therefore there is only strategy that maximizes the payoff for the firm that does not have a dominant strategy. Thus, the outcome will be the same regardless of which firm chooses first

3 Answer the two questions below.

(a) A common form of sales promotion is "buy one get one free". An amusement park offers one free day to its customers who pay for three days at the normal rate. For any additional days, regular price is charged.

(i) Discuss the effect of this promotion on a typical consumer that would take part in the promotion and another that would not take part in this promotion. Include a diagram in your answer. [20%]



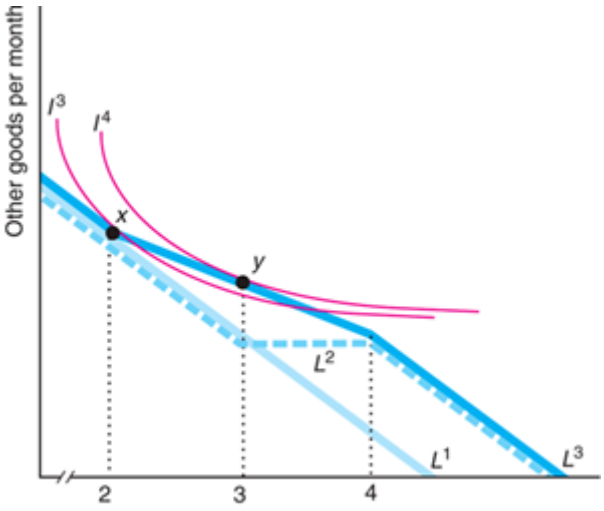
The BOGOF promotion, which provides a fourth day free if one pays for three days creates a kink in the budget line L2.

Without the promotion, consumers A or B's initial budget line is L1. With the BOGOF promotion the new budget line is L2.

Without the promotion, A's indifference curve I1 is tangent to L1 at point x, so she chooses to spend two days at the park. With the BOGOF promotion, A prefers to purchase three days and get the extra day for free with the promotion than pay for and stay only two days. Because her indifference curve I1 cuts the new budget line L2, there is a higher indifference curve I2 that touches L2 at point y, where she chooses to stay four days.

Without the promotion, B chooses to stay two days at x, where her indifference curve I3 is tangent to L1. Because I3 does not cut the new budget line L2, no higher indifference curve can touch L2, so B stays only two days at x and does not take advantage of the BOGOF promotion.

(ii) Another promotion is *half a price* in which, after staying two days at full price, the next two are half of the usual price. For more than four days, however, full price is charged. How does the promotion affect the budget constraint? Would more consumers participate? Include a diagram in your answer. [20%]



With the half price promotion, budget line L3, the third and the fourth days are half price to a customer who pays full price for the first two days, hence L3 is half as steep at L1 from two to four days. Before either promotion is announced, B planned to stay two days, Bundle x, where her indifference curve I3 is tangent to the original budget line L1. Because B's original indifference curve I3 does not cross L2, she will not take advantage of the BOGOF promotion. However, because I3 crosses the half-price promotion budget line L3, B takes advantage of the

promotion. B's optimal bundle is y, where she stays three days, which is located where her indifference cuve I4 is tangent to the half-price promotion line L3.

(iii) Which promotion should the amusement park adopt? What does your answer depend on? [10%]

The park earns the same revenue in both situations eg. if a day cost 100 each, under BOGOF, the park makes 50/day. Under half-price the park also makes 50/day. When deciding whether to use either BOGOF or half-price promotions, a manager needs to know whether its customers are more like A or B. The decision also should take costs into consideration. Extra night is more likely to pay if the park has extra capacity, so the cost of providing an extra night is low.

(b) Discuss the following: markets are efficient, and governments should not intervene. [50%]

Answer could take the stance of emphasising market efficiency (allocative, and productive. Better answers would focus on the role of assumptions for this to be true. Even better answers would discuss the relationship between market failure and the role of government in the economy.

END OF PAPER