Normal-Period Exam — Part A

Maximum duration of Part A: 45 minutes

Full Name: …… A

Student Number: ………………………

1. Mark your answers with an 'O' in the table below. You get 0.625 marks for each right answer, and a 0.208 (0.625/3) deduction for any wrong answer.

2. You cannot look up books or notes of any kind. Invigilators will not help you with the test.

3. You cannot use any calculators in this part. Switch off and put away any mobile phones, computers, and any other data storage device.

4. This test paper must be returned to the invigilator even if you decide to quit.

ANSWER TABLE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b
c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c
d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d

1. **A monopolist charges a single price. Then its marginal revenue curve:**
   a) Lies below the inverse demand curve.
   b) Coincides with the inverse demand curve.
   c) Is horizontal.
   d) Lies above the inverse demand curve.

2. **A monopolist charges a single price. Then which of the following curves coincide?**
   a) Inverse demand curve and marginal revenue curve.
   b) Average revenue curve and marginal revenue curve.
   c) Inverse demand curve and average revenue curve.
   d) None of the other options is true.

3. **A monopolist charges a single price. Which of the following is FALSE?**
   a) When demand falls the firm may reduce output and price.
   b) When demand falls the firm may reduce output and increase the price.
   c) When the price of a variable input falls the firm may increase output and reduce the price.
   d) When the price of a fixed input falls the firm may increase output and reduce the price.

4. **The minimum efficient scale the output level where:**
   a) Average cost curve is upward sloping.
   b) Average cost is at its minimum.
   c) Average cost curve is downward sloping.
   d) None of the other options is true.

5. **A monopolist faces the demand curve $p = 120 - 2y$ and constant marginal cost equal to €20. If it perfectly price discriminates how much will it sell?**
   a) 50.
   b) 40.
   c) 25.
   d) 100.

6. **A monopolist perfectly price discriminates. Then:**
   a) Total surplus is less than that in perfect competition.
   b) Consumer surplus equals that in perfect competition.
   c) Total surplus equals that in perfect competition.
   d) None of the other options is true.

7. **Which of the following BEST characterises a natural monopoly?**
   a) It benefits from strong barriers to entry.
   b) It face no competition from substitute goods.
   c) Its average cost curve is downward sloping where it intercepts the demand curve.
   d) It faces a downward-sloping demand curve.

8. **Assume all firms in a Bertrand oligopoly have equal constant marginal costs. What happens to the equilibrium price as the number of firms increases?**
   a) It increases.
   b) It remains unchanged.
   c) It falls.
   d) None of the other options is correct.

9. **Which of the following is a feature of monopolistic competition?**
   a) Product differentiation.
   b) Homogeneous product.
   c) Barriers to entry.
   d) None of the other options.

10. **In a Cournot oligopoly firms choose:**
    a) Output levels simultaneously.
    b) Output levels sequentially.
    c) Price simultaneously.
    d) Prices sequentially.

11. **In a Cournot duopoly:**
    a) Firms set quantities, and their reaction functions are upward sloping.
    b) A firm may increase profits if it deviates from its equilibrium strategy.
    c) Firms set quantities, and their reaction functions are downward sloping.
    d) None of the other options is true.

12. **Which of the following is true of a cartel?**
    a) If all firms but one exceed the agreed output levels all firms will benefit.
    b) None of the other options is correct.
    c) One firm may benefit by exceeding its agreed output level, but the others will be worse off.
    d) If a firm suspects the others will exceed their agreed output levels its best option is to stick to the agreement.

13. **Assume a Stackelberg duopoly where both firms have the same cost function. Then the leader may have a lower profit than it would have:**
    a) In a Cournot market.
    b) If it were the follower in the Stackelberg market.
    c) In a Bertrand market.
    d) None of the other options is correct.

14. **In a Stackelberg oligopoly firms choose:**
    a) Output levels sequentially.
    b) Output levels simultaneously.
    c) Price levels simultaneously.
    d) None of the other options is correct.

15. **In a cartel:**
    a) Two or more firms coordinate output levels.
    b) Each firm individually maximises its own profit.
    c) None of the other options is correct.
    d) Two or more firms maximise prices.

16. **Two firms in a Bertrand duopoly have different marginal costs functions and no fixed costs. Then in equilibrium:**
    a) One firm will have positive profits.
    b) Both firms will have positive profits.
    c) Both firms will have zero profits.
    d) One firm will have negative profits.

Normal-Period Exam — Part B

Maximum duration of the exam: 1 hour and 30 minutes

5. You cannot look up books or notes of any kind. Invigilators will not help you with the test.

6. Switch off and put away any graphical calculators, computers, mobile phones, or any other data storage device.

1 (3 marks) A firm has a monopoly in two markets with inverse demand curves $p_1(y_1) = 30 - y_1$ and $p_2(y_2) = 40 - y_2$. Resale between markets is impossible. The monopolist has constant marginal costs equal to 10 and has no fixed costs. Find the profit-maximising quantities and prices. Explain your reasoning.

2 In a duopolists market the inverse demand curve is $p(y) = 50 - y$, and firms have costs $c_1(y_1) = 10y_1$ and $c_2(y_2) = 15y_2$.

   a) (2.5 marks) Find the equilibrium price and quantities of the Cournot model. Explain your reasoning.

   b) (2.5 marks) Now assume firm 1 credibly announces its output level before firm 2 decides its own output level. How much will each firm produce and what will be the price? Explain your reasoning.

3 (2 marks) A necessary condition for joint profit maximisation in a cartel is that each firm produces an output level (as long as it is actually producing) such that marginal cost is the same for all firms. Why is that?

ANSWERS

1 The monopolist maximises profit equating both marginal revenues to the marginal cost.
   Revenues and marginal revenues:

   $r_1(y_1) = p_1(y_1)y_1 = 30y_1 - y_1^2$; $MR_1 = \partial r_1(y_1)/\partial y_1 = 30 - 2y_1$;
   $r_2(y_2) = p_2(y_2)y_2 = 30y_2 - y_2^2$; $MR_2 = \partial r_2(y_2)/\partial y_2 = 40 - 2y_2$;

   $MC = MR_1 \Leftrightarrow 10 = 30 - 2y_1 \Leftrightarrow y_1 = 10$; $p_1(10) = 30 - 10 = 20$.
   $MC = MR_2 \Leftrightarrow 10 = 40 - 2y_1 \Leftrightarrow y_2 = 15$; $p_1(15) = 40 - 15 = 25$.

   Alternatively we could maximise the profit function. $MC = 10$ means $c(y) = 10y$, so
   max $\pi = p_1(y_1)y_1 + p_2(y_2)y_2 - c(y_1 + y_2) = 30y_1 - y_1^2 + 30y_2 - y_2^2 - 10(y_1 + y_2)$
   $\partial \pi/\partial y_1 = 30 - 2y_1 - 10 = 0 \Leftrightarrow y_1 = 10$
   $\partial \pi/\partial y_2 = 40 - 2y_1 - 10 = 0 \Leftrightarrow y_1 = 15$

2a) Each firm maximises its profit assuming the other's output constant. This yields the reaction functions:

max $\pi_1 = p(y_1 + y_2)y_1 - c_1(y_1) = (50 - y_1 - y_2)y_1 - 10y_1 = 50y_1 - y_1^2 - y_1y_2 - 10y_1$
$\partial \pi_1/\partial y_1 = 50 - 2y_1 - y_2 - 10 = 0 \Leftrightarrow y_1 = 20 - 0.5y_2 = f_1(y_2)$ Firm 1's reaction function.

max $\pi_2 = p(y_1 + y_2)y_2 - c_2(y_2) = (50 - y_1 - y_2)y_1 - 10y_1 = 50y_1 - y_1y_2 - y_2^2 - 15y_2$
$\partial \pi_1/\partial y_1 = 50 - y_1 - 2y_2 - 15 = 0 \Leftrightarrow y_2 = 17.5 - 0.5y_1 = f_2(y_1)$ Firm 2's reaction function.

In the Cournot equilibrium the two reaction functions cross, i.e. each firm maximises its profit given the other's output:

$$\begin{cases} y_1 = 20 - 0.5y_2 \\ y_2 = 17.5 - 0.5y_1 \end{cases} \begin{cases} y_1 = 20 - 0.5y_2 \\ y_2 = 17.5 - 0.5(20 - 0.5y_2) \end{cases} \begin{cases} y_1 = 20 - 0.5y_2 \\ y_2 = 7.5 + 0.25y_2 \end{cases}$$

$$\begin{cases} y_1 = 20 - 0.5 \times 10 = 15 \\ y_2 = 10 \end{cases}$$

Total output: $y = 15 + 10 = 25$.
Price: $p(25) = 50 - 25 = 25$.

2b) This is the Stackelberg model. Firm 2 will observe firm 1's quantity and produce its profit-maximising output given that quantity, which is given by its reaction function, found in a). Firm 1 knows this and will decide its own level of output taking this into account:

max $\pi_1 = p[y_1 + f_2(y_1)]y_1 - c_1(y_1) = [50 - y_1 - (17.5 - 0.5y_1)]y_1 - 10y_1 = 32.5y_1 - 0.5y_1^2 - 10y_1$
$\partial \pi_1/\partial y_1 = 32.5 - y_1 - 10 = 0 \Leftrightarrow y_1 = 22.5$.

$y_2 = f_2(22.5) = 17.5 - 0.5 \times 22.5 = 6.25$

Total output: $y = 22.5 + 6.25 = 28.75$.
Price: $p(28.75) = 50 - 28.75 = 21.25$.

3 Whatever total output the cartel produces, it maximises profit only if it produces it at a minimum cost. If firms are producing with different marginal costs total cost can be reduced by producing less in the high-marginal cost firm and more in the low-marginal cost firm.

ANSWERS TO PART A

Version	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	a	c	d	b	a	c	c	b	a	a	c	c	d	a	a	a
B	a	c	b	d	b	a	c	d	c	b	d	c	b	d	a	d
C	b	b	d	c	d	a	d	b	a	b	b	c	a	c	a	d
D	d	c	b	a	b	d	d	c	a	d	a	b	b	a	c	b