SUBJECT, COURSE AND CODE: ECONOMICS: INDUSTRIAL ORGANISATION: ECON305
DURATION: THREE HOURS

EXTERNAL EXAMINER: Prof. T. Mutambara
INTERNAL EXAMINERS: Ms N. Damoyi
Prof. J. Fairburn

INSTRUCTIONS TO CANDIDATES

SECTION A: WRITTEN QUESTIONS

- ANSWER TWO QUESTIONS FROM THIS SECTION.
- Please answer this section in a separate answer book.

SECTION B: WRITTEN QUESTIONS

- ANSWER TWO QUESTIONS FROM THIS SECTION.
- Please answer this section in a separate answer book.

SECTION C: MULTIPLE-CHOICE QUESTIONS

- Candidates are required to attempt all 24 MCQ questions.
- There is no negative marking.
- Only HB pencil may be used on the MCQ answer sheet.
Section A

[100 marks]

Answer TWO of the following three questions. Show ALL workings.

Question One

50 marks

Wonka and Choccies are the only two firms in the chocolate industry, producing chocolate truffles. Chocolate truffles are produced "per box". These two firms choose output independently, and simultaneously. Market demand facing this chocolate industry is

\[ P = 72 - 2Q \]

where \( Q = (q_w + q_c) \)

and \( q_w \) is the quantity produced by Wonka and \( q_c \) is the quantity produced by Choccies.

The firms marginal cost of producing one box of chocolate truffles is \( c \) equal to

\[ MC_w = 12. \]
\[ MC_c = 12. \]

a) Calculate Wonka's and Choccies' best response functions. Illustrate these on a clearly labelled diagram (label intercepts, axis, and functions).

[20]

b) Calculate the equilibrium quantities, price and profit. Plot the quantities on your diagram in (a).

[15]

c) If Wonka's marginal cost decreased to \( MC_w = 8 \), what happens to its best response function? Illustrate this on your diagram in (a). Calculate Wonka's new best response function and quantity. Comment on the changes that occur in this Cournot duopoly due to Wonka's decrease in marginal cost.

[15]
Question Two

Consider two producers: Snazzy Bikes and Plush Seats. Snazzy Bikes are the only bicycle makers in the bicycle industry. They make bicycles and Plush Seats make bicycle seats. Snazzy Bikes face an inverse demand curve for bikes of

\[ P = 450 - 4Q. \]

Snazzy Bikes' marginal cost has two components. First, they have to buy bike seats from Plush Seats at a cost of \( P_s \) per seat. Then, they have to assemble the bike with all the other parts, which costs R50 per unit, that is \( MC = 50 \). There are no fixed costs.

Plush Seats is the only maker of bike seats around. They have no fixed costs either, and a marginal cost of R16 i.e. \( MC = 16 \).

There is one bike seat per bike, so the total quantity of bike seats sold is the same as the total quantity of bikes sold.

a) Assuming that Snazzy Bikes and Plush Seats operate as independent monopolists (vertical separation) in their respective industries, calculate quantities and prices in the market, profits of each firm, and consumer surplus. [15]

b) Next assume that Snazzy Bikes and Plush Seats vertically integrate. Calculate the new quantities and prices in the market, and new profits and new consumer surplus. Illustrate this on a clearly labelled diagram. [25]

c) Compare the answers in (b) with the answers in (a) (compare price, quantities, profit and consumer surplus). What can you conclude about vertical integration and vertical separation? Explain your conclusion by making reference to and explaining the double marginalisation phenomenon. Does vertical integration solve double marginalisation? [10]
Question Three

Fun World realises that demand for bumper car rides is lower among non-pensioners than among pensioners. Management estimates that the demand functions for the two groups are:

Non-pensioners (aged under 65):

\[ q_1 = 40 - p \]

Pensioners (aged 65 and over):

\[ q_2 = 80 - p \]

Assume that it costs Fun World R5 to provide one bumper car ride i.e. \( MC = 5 \). Each ride is priced at R5. Fun World also charges a fixed entrance fee of T.

a) On two separate diagrams, draw the demand curves for the non-pensioners and pensioners and show the horizontal line at the price. Calculate the quantity of rides each type of consumer demands at a price of R10. Show these quantities on your diagrams. [10]

b) If Fun World wants to ensure that both non-pensioners and pensioners both ride the bumper car, calculate the fixed fee, T, which the management will charge. [5]

c) Calculate the total profit that Fun World earns from supplying both types of customers. [5]

d) With the aid of a new diagram, illustrate the change in profits when Fun World raises the price above marginal cost to R8 per ride and reduces the fixed fee, T, correspondingly. Calculate the change in profit. Explain why the gain in profits from pensioners is greater than the loss in profits from non-pensioners. [30]
Section B  

[100 marks]

Answer TWO of the following three questions. Show ALL workings.

Question 4  

50 marks

In this question firm 1 is a Stackelberg leader and firm 2 is a Stackelberg follower. There is a fixed cost of production for firm 2 which means that it is not profitable for firm 2 to operate at very low scale. Therefore firm 1 can deter entry by firm 2 if it produces a sufficiently large output; this is called the limit output and it depends on firm 2's fixed cost of production.

Suppose that the industry inverse demand curve is

\[ P = 50 - (q_1 + q_2). \]

The cost functions for firms 1 and 2 are

\[ C_1(q_1) = 14q_1 + F \quad \text{and} \quad C_2(q_2) = 14q_2 + F, \]

where \( F \) is the fixed cost of production.

(a) Write down firm 2's profit function and show that firm 2's best response function is

\[ q_2 = 18 - \frac{1}{2} q_1. \]  \( \text{(1)} \)

Graph this on the usual diagram and label the endpoints of the best response function.  \([10]\)

(b) When equation (1) is incorporated into firm 1's profit function the result is

\[ \pi_1 = 18q_1 - \frac{1}{2} q_1^2 - F. \]  \( \text{(2)} \)

You do not have to derive equation (2).

Calculate firm 1's profit-maximising output and -- using equation (1) -- firm 2's best response to that output.

Indicate this point on your diagram and label it A (for "accommodation"). Draw firm 1's isoprofit curve at point A.  \([10]\)
The formula for firm 1's limit output in this example is

\[ q_1^L = 36 - 2\sqrt{F}. \tag{3} \]

You do not have to derive equation (3).

For various values of \( F \) the following table gives the limit output \( (q_1^L) \) and the profits of firm 1 from producing at that output level and deterring entry \( (\pi_1^D) \). The final column gives the profits of firm 1 from instead accommodating entry by producing at the Stackelberg output level \( (\pi_1^A) \).

<table>
<thead>
<tr>
<th>( F )</th>
<th>( \sqrt{F} )</th>
<th>( q_1^L )</th>
<th>( \pi_1^D )</th>
<th>( \pi_1^A )</th>
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<tr>
<td>0</td>
<td>0</td>
<td>36</td>
<td>0</td>
<td>162</td>
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<tr>
<td>36</td>
<td>6</td>
<td>24</td>
<td>252</td>
<td>126</td>
</tr>
</tbody>
</table>

(c) On your previous diagram illustrate the case of \( F = 4 \). Label the entry deterrence point \( D_1 \). Use isoprofit curves to briefly explain whether firm 1 chooses to accommodate or deter.

\[ \text{[10]} \]

(d) On a new version of the diagram illustrate the case of \( F = 16 \). Label the entry deterrence point \( D_2 \) and the accommodation point \( A \). Again use isoprofit curves to briefly explain whether firm 1 chooses to accommodate or deter.

\[ \text{[10]} \]

(e) The Stackelberg model allows an established firm (firm 1 in our example) to win market share from its rival and even to deter entry by its rival. Briefly discuss how these same effects might be achieved in a Cournot model.

\[ \text{[10]} \]
Question 5

The inverse demand curve for a product is

\[ P = 160 - Q. \]  \hspace{1cm} (1)

*Before* an innovation takes place the product can be produced at total cost

\[ C_B(Q) = 110Q. \]  \hspace{1cm} (2)

Therefore \( AC = MC = 110. \)

In this question we will consider both drastic and non-drastic innovations. If there is a *drastic* innovation the monopoly innovator can produce at total cost

\[ C_D(Q) = 30Q. \]  \hspace{1cm} (3)

If there is a *non-drastic* innovation the monopoly innovator can produce at total cost

\[ C_N(Q) = 90Q. \]  \hspace{1cm} (4)

(a) First consider the *drastic* innovation (equation (3)). What is the gain in profit for an innovating firm that was a *monopoly producer* prior to the innovation? What is the gain in profit for an innovating firm that was *one of many producers* prior to the innovation? Use a diagram to illustrate the prices and profits for the drastic innovation case. What does your answer tell you about the incentives to innovate under monopoly and competition?  

[20]

(b) Next consider the *non-drastic* innovation (equation (4)). What is the gain in profit for an innovating firm that was a *monopoly producer* prior to the innovation? Use a new diagram to illustrate the prices and profits for this case.  

[15]

(c) Again consider the *non-drastic* innovation (equation (4)). What is the gain in profit for an innovating firm that was *one of many producers* prior to the innovation? Use a new diagram to illustrate the prices and profits for this case. What do your answers to parts (b) and (c) tell you about the incentives to innovate under monopoly and competition?  

[15]
Question 6

There are $n$ firms in a Cournot oligopoly. All firms are identical and the total cost function of any firm $i$ is given by

$$C(q_i) = a + c q_i,$$  \hspace{0.5cm} i = 1, 2, \ldots, n.

$a$ is therefore a fixed cost of production and it represents advertising expenditure.

The inverse demand curve for the industry is

$$p = S - Q.$$

$S$ is the intercept of the inverse demand curve and represents the \textit{scale} of the industry. $Q$ is total industry output and is given by $Q = q_1 + q_2 + \cdots + q_n$.

(a) Show that firm 1 will maximize its profits by choosing output so that the following condition is satisfied:

$$S - c - 2q_1 - Q = 0,$$

where

$$Q_1 = q_2 + \cdots + q_n.$$

i.e. $Q_1$ is the combined output of all firms other than firm 1. \hspace{1cm} [15]

(b) Explain why in a symmetric equilibrium the output of firm 1 is equal to

$$q_1 = \frac{S - c}{n + 1}$$

and why the profit of firm 1 is equal to

$$\pi_1 = \frac{(S - c)^2}{(n + 1)^2} - a.$$ \hspace{1cm} [15]

(c) If all firms make zero profits in equilibrium the number of firms, $n^C$, is given by the equation

$$\frac{1}{n^2 + 1} = \frac{\sqrt{a}}{S - c}$$

Explain why this equation gives a relationship between industry concentration and the scale of the industry. Sketch this relationship and show what happens when advertising expenditure $(a)$ increases. Provide a brief intuitive discussion of this relationship. \hspace{1cm} [20]
1. Which of the following statements is correct?

a) A potential Pareto improvement (PPI) is a move from A to B where the person who becomes better off could compensate the person who becomes worse off but chooses not to.
b) In measuring market power, the more elastic the firm’s demand, the greater its degree of market power.
c) A deadweight loss occurs when an outcome is Pareto optimal and all mutually beneficial transactions between producers and consumers can be completed freely.
d) The competitive fringe of firms maximise profit according to the residual demand curve portion of market demand not supplied by the dominant firm.
e) None of the above statements are correct.

Use the above diagram to answer the questions 2 and 3.

2. If the dominant firm’s marginal cost is $MC_D$ then:

a) the dominant firm is considerably more efficient than the fringe firms; the fringe cannot profitably produce and the dominant firm can ignore it.
b) the dominant firm will produce $Q^D(P^D)$.
c) the fringe firms will produce half of the dominant firm’s output.
d) both a) and b) are correct.
e) none of the above.
3. In the dominant firm (price leadership) model:

   a) the dominant firm's market power is less than a monopolist's.
   b) below \( P^0 \) only the competitive fringe of firms will supply output.
   c) if the dominant firm and the competitive fringe produce, there will be a lower equilibrium price than would prevail under perfect competition.
   d) both a) and c) are correct.
   e) none of the above.

4. In a Nash equilibrium in the Bertrand model with homogenous products, the price of both firms is equal to:

   a) the monopoly price.
   b) the price in the Cournot Nash equilibrium.
   c) marginal cost.
   d) a price that is higher than the monopoly price.
   e) one of the above.

![Diagram](image)

Use the above diagram to answer question 5.

5. In the Cournot game firm two's best response curve is represented by line ____ and the isoprofit curves shown are those of firm _____.

   a) A; two
   b) A; one
   c) C; two
   d) C; one
   e) none of the above.
6. Suppose there is a symmetric Cournot duopoly and firm ONE's best response curve is \( q_1 = 90 - \frac{1}{2}q_2 \). Find the Nash equilibrium outputs for each firm.

a) 30  
b) 45  
c) 60  
d) 80  
e) 90

Use the above diagram to answer question 7.

7. Which of the following statements is true regarding Point M?

a) Firms make the most profit since it is the most efficient point.  
b) Point M is where both firm ONE and firm TWO collude and charge price \( P^2 \).  
c) Point M is where the Bertrand Paradox arises.  
d) At Point M each firm has an incentive to cheat and return to its reaction function.  
e) Firms make zero profit at Point M.
8. Consider the demand curves for two differentiated goods. Demand for good 1 is

\[ Q_1 = 30 - 2p_1 + p_2 \]

The marginal cost of firm 1 is \( MC_1 = 3 \). The demand for good 2 is

\[ Q_2 = 15 - 2p_2 + p_1 \]

The marginal cost of firm 2 is \( MC_2 = 6 \).

Which of the following is firm 1's best response function?

a) \( p_1 = 9 + \frac{1}{4}q_1 \)

b) \( p_1 = 9 + 0.1p_2 \)

c) \( p_1 = 9 + \frac{1}{4}p_2 \)

d) \( p_1 = 9 + 0.1p_1 \)

e) \( p_1 = 9 + \frac{1}{4}q_2 \)

9. Which of the following could be a way to solve the double marginalisation problem?

a) Vertical integration.

b) Minimum retail prices.

c) Two part tariffs which consist of a fixed fee and a variable fee equal to the downstream firm's marginal cost.

d) Eliminating downstream competition.

e) None of the above.

10. Firms who want to capture more surplus can use which of the following mechanism(s):

I. Linear pricing.

II. Quality discrimination.

III. Market segmentation.

a) I only.

b) I, II, and III.

c) II only.

d) II and III.

e) III only.
The above diagram illustrates the two types of night club consumers a night club manager is faced with. Use the above diagram to answer questions 11 and 12. The entrance fee per visit is R10. There is also a membership fee which customers have to pay whatever the number of visits.

11. If the night club manager wants to ensure that both the low demand and the high demand enter the night club, what is the membership fee that the manager will charge?

   a) 100
   b) 1800
   c) 300
   d) 200
   e) Not enough information to calculate the answer.

12. What is the total profit that the night club earns from supplying one customer of each type?

   a) 1100.
   b) 1000.
   c) 700.
   d) 2900.
   e) 4500.
Question 13 refers to the figure below, which shows a stylized entry game.

13. What are the two conditions required in order that (i) an aggressive incumbent would prefer to fight than to accommodate the entrant, and (ii) that an incumbent would prefer to be aggressive rather than passive?

a) (i) \( c < \pi^d - \pi^w \) and (ii) \( c < \pi^m - \pi^d \);
b) (i) \( c > \pi^d - \pi^w \) and (ii) \( c < \pi^m - \pi^d \);
c) (i) \( c > \pi^d - \pi^w \) and (ii) \( c > \pi^m - \pi^d \);
d) (i) \( c < \pi^d - \pi^w \) and (ii) \( c > \pi^m - \pi^d \);
e) None of the above.
14. The best response functions for firms 1 and 2 are given by

\[ q_2 = 12 - \frac{1}{2} q_2 \quad \text{and} \quad q_2 = A - \frac{1}{2} q_1 \]

if firm 2 makes an investment that increase \( A \) from \( A = 12 \) to \( A = 15 \) then what happens to firm 1’s market share?

a) It is 50% before the investment and 50% after the investment;
b) It is 50% before the investment and 67% after the investment;
c) It is 50% before the investment and 33% after the investment;
d) It is 50% before the investment and 0% after the investment;
e) It is 100% before the investment and 0% after the investment.

15. Which of the following economists is associated with the following concepts: i) the replacement effect; ii) creative destruction; iii) the efficiency effect?

a) i) Kenneth Arrow; ii) Joseph Schumpeter; iii) Gilbert and Newbery;
b) i) Joseph Schumpeter; ii) Kenneth Arrow; iii) William Nordhaus;
c) i) Kenneth Arrow; ii) Joseph Schumpeter; iii) William Nordhaus;
d) i) Joseph Schumpeter; ii) Kenneth Arrow; iii) Gilbert and Newbery;
e) i) Kenneth Arrow; ii) Joseph Schumpeter; iii) Paul Klemperer.

Question 16 refers to the table below, which gives market shares for the five firms in two industries.

<table>
<thead>
<tr>
<th></th>
<th>Industry A</th>
<th>Industry B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm 1</td>
<td>40%</td>
<td>30%</td>
</tr>
<tr>
<td>Firm 2</td>
<td>15%</td>
<td>30%</td>
</tr>
<tr>
<td>Firm 3</td>
<td>15%</td>
<td>20%</td>
</tr>
<tr>
<td>Firm 4</td>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td>Firm 5</td>
<td>15%</td>
<td>10%</td>
</tr>
</tbody>
</table>

16. Let CR4 denote the four-firm concentration ratio and let HHI denote the Hirschman-Herfindahl index. Which of the following statements is correct?

a) Industry A is more concentrated according to both CR4 and HHI;
b) Industry B is more concentrated according to both CR4 and HHI;
c) Industry A is more concentrated according to CR4 but less concentrated according to HHI;
d) Industry B is more concentrated according to CR4 but less concentrated according to HHI;
e) Industry A and industry B are equally concentrated according to CR4 and HHI.
17. Consider a competitive industry. The demand curve depends on price and on income (Y) but not on industry wages (W). The supply curve depends on price and industry wages (W) but not on income (Y). Which of the following statements is correct?

a) As Y varies a researcher can identify the supply curve and as W varies the researcher can identify the demand curve;

b) As Y varies a researcher can identify the demand curve and as W varies the researcher can identify the supply curve;

c) As W varies a researcher can identify both the demand curve and the supply curve;

d) As Y varies a researcher can identify both the demand curve and the supply curve;

e) Neither the supply curve nor the demand curve can be identified with variation in Y and W.

18. Suppose an empirical study uses the following measure of firm performance

\[
\frac{\text{Revenue} - \text{Total Cost}}{\text{Revenue}}
\]

Which of the following measures is this equal to (where TC, AC and MC denote total cost, average cost and marginal cost and P denotes price)?

a) \( \frac{p-MC}{P} \)

b) \( \frac{p-TC}{P} \)

c) \( \frac{p-AC}{P} \)

d) The Lerner index;

e) Both a) and d).

19. Empirical research sometimes uses the following measure of firm performance:

\[
\frac{\text{stock market value}}{\text{replacement cost of assets}}
\]

What is the name of this measure?

a) Tobin's q;

b) the profit-revenue ratio;

c) the rate of return on capital;

d) the price-cost margin (where cost equals average cost);

e) the price-cost margin (where cost equals marginal cost);
20. Suppose that a regulated firm supplies three products, 1, 2 and 3, and the absolute value of the elasticity of demand for the products are $\varepsilon_1$, $\varepsilon_2$ and $\varepsilon_3$, where

$$\varepsilon_1 < \varepsilon_2 < \varepsilon_3$$

If $pcm_i$ denotes the price cost margin for product $i$ then according to Ramsey pricing principles which of these conditions should be satisfied?

a) $pcm_1 > pcm_2 > pcm_3$;
b) $pcm_1 = pcm_2 = pcm_3$;
c) $pcm_1 < pcm_2 < pcm_3$;
d) $pcm_1 > pcm_3 > pcm_2$;
e) $pcm_2 > pcm_1 > pcm_3$.

21. A regulated industry has $N$ consumers and a total cost function:

$$C(Q) = f + cQ.$$  

Let $p$ denote the price per unit and $A$ the access price per consumer. Which of the following did Ronald Coase propose as the best way of setting prices?

a) $A = 0$, $p = c + f / Q$;
b) $A = f$, $p = c$;
c) $A = f / N$, $p = c + f / Q$;
d) $A = f / N$, $p = c$;
e) $A = c + f / Q$, $p = 0$.  

22. In which of the following cases is Ramsey pricing associated with the largest welfare loss?

a) the demand curve is elastic and there is a large gap between average and marginal cost;
b) the demand curve is inelastic and there is a large gap between average and marginal cost;
c) the demand curve is elastic and there is a small gap between average and marginal cost;
d) the demand curve is inelastic and there is a small gap between average and marginal cost;
e) none of the above: the welfare loss is the same in all four cases.

23. If it is not possible for a consumer to know the quality of a good *even after consumption*, then this is known as:

a) A search good;
b) An experience good;
c) An inspection good;
d) A credence good;
e) None of the above.

24. A high quality product costs $c_H$ to produce and a low quality product costs $c_L$ to produce. The average consumer has reservation price $R$. There are two periods. If the price in each period is set equal to $R$, and $a$ is advertising expenditure per unit what are the two conditions required for advertising to be an effective signal that a particular product is high quality?

a) $R - c_L \leq a$, $2(R - c_H) > a$;
b) $R - c_L \geq a$, $2(R - c_H) < a$;
c) $R - c_H \leq a$, $2(R - c_L) > a$;
d) $R - c_H \geq a$, $2(R - c_L) < a$;
e) $0 \leq a$, $R > a$. 