
AP[®] Microeconomics

Sample Student Responses and Scoring Commentary

Set 1

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Free Response Question 3

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AP[®] MICROECONOMICS

2019 SCORING GUIDELINES

Question 3

6 points (1 + 1 + 1 + 1 + 2)

(a) 1 point

- One point is earned for stating the actions that maximize the combined profits are for Patrick’s Pie to “Advertise” and for Dee’s Pizzeria to “Stay Out.”

(b) 1 point

- One point is earned for stating that neither firm has an incentive to cheat and for explaining that Dee’s Pizzeria profits would decrease from \$0 to -\$2 if Dee cheated and that Patrick’s Pie’s profits would decrease from \$175 to \$100 if Patrick cheated.

(c) 1 point

- One point is earned for stating that Patrick’s Pie does not have a dominant strategy.

(d) 1 point

- One point is earned for stating two Nash equilibria as:
 - Patrick’s Pie “Do Not Advertise” and Dee’s Pizzeria “Enter”
 - Patrick’s Pie “Advertise” and Dee’s Pizzeria “Stay Out”

(e) 2 points

- One point is earned for correctly redrawing the payoff matrix and showing the effect of the side payment.

| | | Dee’s Pizzeria | |
|---------------|------------------|----------------|-------------|
| | | Enter | Stay Out |
| Patrick’s Pie | Advertise | \$50, -\$2 | \$155, \$20 |
| | Do Not Advertise | \$150, \$15 | \$80, \$20 |

- One point is earned for stating that the Nash equilibrium is for Patrick’s Pie to “Advertise” and for Dee’s Pizzeria to “Stay Out.”

3A

ANSWER PAGE FOR QUESTION 3

a) Patrick's pie Advertise & Dee's Pizzeria Stay Out

b) Neither would want to cheat. Patrick is making the most profit of his 4 possibilities & if he chose to not advertise his profit would fall from \$175 to \$100. As for Dee's although he is making \$0 if he tried to cheat out this combination his profit would actually become a loss of \$2 (since Patrick would still be advertising) so since $0 > -2$ he will not cheat.

c) No

d) Nash equilibria are: Patrick Not Advertising & Dee's Enter, & also Patrick Advertising & Dee's staying out

e)

| | | Dee's Pizzeria | |
|---------------|------------------|----------------|-------------|
| | | Enter | stay out |
| Patrick's Pie | Advertise | \$50, \$-2 | \$155, \$20 |
| | Do Not Advertise | \$150, \$15 | \$80, \$20 |

ii) Patrick's Pie advertises & Dee's Pizzeria stays out

GO ON TO THE NEXT PAGE.

(a) Total profits are maximized if Dee's Pizzeria stays out and Patrick's Pie advertises.

(b) Yes, Dee's Pizzeria has an incentive to cheat by entering. If Dee's stays out to combine total profits, they will as a company make \$0. However, if they entered, they could make \$15 instead, as long as Patrick's Pie does not advertise.

(c) No

(d) Do Not Advertise, Enter (\$150, \$15)

(e) (i)

| | | Dee's Pizzeria | |
|---------------|------------------|----------------|-------------|
| | | Enter | Stay Out |
| Patrick's Pie | Advertise | \$50, -\$2 | \$155, \$20 |
| | Do Not Advertise | \$150, \$15 | \$80, \$20 |

(ii) Advertise, Stay out (\$155, \$20)

GO ON TO THE NEXT PAGE.

ANSWER PAGE FOR QUESTION 3

3a. If Patrick's advertises and Dee's stays out, then the combined total profits will be maximized.

b. Since the players have complete information, neither of them have incentive to cheat because Patrick's wants to maximize profit, which means the advertising option looks more appealing as long as Dee's stays out, and with this in mind, Dee's won't want to enter because they know that Patrick's will want to advertise, which will make Dee's profit negative -2 compared to 0 .

c. yes

d. $(50, -2)$ because they will both want to maximize their own profits, but that will result in the above stated combination

| e.i. | dee's | |
|------------------|---------------|---------------|
| | enter | stay out |
| advertise | $\$30, \18 | $\$155, \20 |
| do not advertise | $\$130, \35 | $\$80, \20 |

↑
patrick's

ii. $(30, 18)$

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AP[®] MICROECONOMICS

2019 SCORING COMMENTARY

Question 3

Note: Student samples are quoted verbatim and may contain spelling and grammatical errors.

Overview

This question assessed students' ability to apply game theory to analyze the behavior of two players (firms: Patrick's Pie and Dee's Pizzeria) using a payoff matrix. The concepts in the question included interpretation of the payoff matrix, identifying the actions that maximize the combined payoffs, understanding and identifying the dominant strategy, and identifying the Nash equilibrium. Students also needed to demonstrate the ability to redraw a payoff matrix when the market conditions change.

In part (a) students were expected to use the payoff matrix to determine which of the actions maximize players' combined total profits by adding the individual profits. Patrick's Pie choosing "Advertise" and Dee's Pizzeria choosing to "Stay Out" maximize the total profits.

Using the information in the matrix, in part (b) students were expected to recognize that neither player has an incentive to cheat and explain, using numbers, that if Dee's Pizzeria cheated, its profits would decrease from \$0 to -\$2, and if Patrick's Pie cheated, its profits would decrease from \$175 to \$100.

Part (c) required students to demonstrate their understanding of a dominant strategy by stating that Patrick's Pie does not have a dominant strategy.

In part (d) students were expected to recognize that this game has two Nash equilibria and identify them as follows: Patrick's Pie "Do Not Advertise" and Dee's Pizzeria "Enter"; and Patrick's Pie "Advertise" and Dee's Pizzeria "Stay Out."

In part (e)(i) students had to demonstrate how a change in market conditions (Patrick's Pie pays Dee's Pizzeria \$20 if Dee chooses to "Stay Out") affects the payoff matrix. Students needed to redraw the payoff matrix with lower profits for Patrick's Pie ($\$175 - \$20 = \$155$; $\$100 - \$20 = \$80$), and higher profits for Dee's Pizzeria ($\$0 + \$20 = \$20$; $\$0 + \$20 = \$20$) given Dee's Pizzeria choice to "Stay Out." In part (e)(ii) students needed to identify the new Nash equilibrium: Patrick's Pie chooses "Advertise" and Dee's Pizzeria chooses to "Stay Out."

Sample: 3A

Score: 6

The student answers all parts of the question correctly and earned all 6 points.

Sample: 3B

Score: 4

The response did not earn 1 point in part (b) because it incorrectly states that Dee's Pizzeria has an incentive to cheat. The response did not earn 1 point in part (d) because only one Nash equilibrium is identified.

Sample: 3C

Score: 1

The response earned 1 point in part (a) for correctly identifying the actions that maximize the combined total profits for both players—Patrick's Pie "Advertise" and Dee's Pizzeria "Stay Out."