**MANAGERIAL ECONOMICS AND INDUSTRIAL ORGANIZATION**

**January 2024**

1. Consider the following strategic game regarding the timetable of the flights for the route Milan-New York of two competing airline companies. Find the Nash equilibrium/equilibria of the simultaneous game. Assume now that American Airlines acts as a first mover. Find the subgame perfect equilibrium of the sequential game.

|  |  |  |  |
| --- | --- | --- | --- |
|  American AirlinesAlitalia | Morning | Noon | Evening |
| Morning | (30,18) | (25,20) | (24,40) |
| Noon | (45,25) | (50,31) | (32,32) |
| Evening | (60,30) | (33,25) | (40,24) |

The Nash equilibrium of the simultaneous game is Evening, Morning, with payoffs (60,30).

If the game becomes sequential and American Airlines is the first mover, the subgame perfect equilibrium becomes Noon, Noon with payoffs (50,31). Therefore, American Airlines can exploit a first mover advantage.

 (**18**,30)

 m n (**25**,45)

 m Al e (**30**,60)

 n m n (**20**,25)

 **AM** Al e **(31,50)**

 (**25**,33)

 e m

 Al n (**40**,24)

 (**32**,32)

 e (**24**,40)

2) The production of frozen pasta requires two ingredients: pasta and sauce. There is a monopolist that produces the sauce (firm A) and a monopolist that produces pasta (firm B). They both sell pasta and sauce to a food processing monopolist (firm C) that sells the frozen pasta in supermarkets. The final demand for frozen pasta is P = 50 – Q. The marginal cost for processing the food is equal to 5. The marginal cost of producing pasta is equal to 5 and the marginal cost of producing sauce is equal to 2.5. Find the equilibrium (quantities, final price of frozen pasta, profits of the three firms). Imagine that firm B merges with firm A. Compute the new equilibrium.

Starting from the downstream stage, firm C profits are πC = (50-Q)Q- PpQ – PsQ – 5Q. By making the first derivative with respect to Q we get the inverse demand functions for firms A and B: 50-2Q-5-Pp-Ps=0, therefore Q = (45 – Pp – Ps)/2. From the above expression we get

Pp= 45-2Q – Ps and Ps =45 – 2Q – Pp. Equating marginal revenues with marginal costs:

 45-4Q-Ps=2.5 and 45-4Q-Pp=5. From this we obtain Ps + Pp = 82.5-8Q. Substituting in Q = (45 – Pp – Ps)/2 one gets Q=(45-82.5+8Q)/2🡪 6Q=37.5 and Q=6.25; P=43.75, Pp=17.5 and Ps=15. Therefore, sauces are sold at 15, pasta at 17.5 and the frozen pasta at 43.75.

Profits are, respectively:

 πC=(43.75-5-15-17.5)x6.25=39.06, πB=(17.5-5)x6.25=78.1 and πA=(15-2.5)x6.25=78.1

If firm B merges with firm A we have two successive monopolies. Profits of firm C are πC = (50-Q)Q- Pp+s Q – 5Q. By making the first derivative with respect to Q we get the inverse demand functions for the firm A+B: 50-2Q-5-Pp+s=0, therefore Q = (45 – Pp+s)/2. From the above expression we get Pp+s=45-2Q which is the inverse demand function for the merged firm.

 Equating marginal revenues with marginal costs: 45-4Q=7.5 one gets Q=9.375. Therefore, Pp+s= 26.25 and P=40.625. Profits of the merged firm are equal to πA+B = (26.25-7.5)x9.375=175.78 and profits of firm C to (40.625-26.25-5)x9.375=87.89.

3) Consider a duopoly with differentiated products and price competition, where the demand functions are respectively: q1 = 1-p1 + p2 and q2 = 1-p2 + p1 and marginal costs are respectively c1 = c2 = c - m, where m represents an investment in research and development which has the effect of reducing the marginal cost.

 Identify equilibrium quantities, prices and profits.

Given the following profit functions:

π1 = (p1-c+m)(1-p1+p2), π2 = (p2-c+m)(1-p2 + p1) and setting the first derivative equal to zero we obtain the reaction functions:

dπ1 / dp1 = 0; 1-2p1 + p2 + c-m = 0 from which we obtain p1 =(1+p2+c-m)/2

dπ2/dp2 = 0;1-2p2+p1+c-m=0 from which it is obtained p2=(1+p1+c-m)/2

Equalizing the two reaction functions we get

p1=p2= 1+c-m; q1=q2=1 and π1 =π2 = 1.

In this example, the investment in research and development reduces the equilibrium price, but the quantities and profits do not change, so only consumers benefit.

4) Two packaging firms are selling tea boxes. The inverse demand function is P = 75 – 5Q and marginal costs are equal to MC1= 2 + 0.1 q1 and MC2= 6. Find the equilibrium in the case of price competition. How this equilibrium will change if firm 2 is reducing marginal cost from 6 to 5?

Firm 1 has a lower marginal cost and will set a price equal (slight below) to the marginal cost of firm 2. P=6 q1=Q=13.8. Since MC1= 2+0.1q1, Total cost is TC1=2q1+0.05q12. Therefore, profits will be equal to 6x13.8-2x13.8-0.05x13.82= 45.678. If firm 2 is reducing marginal cost from 6 to 5, the new price will be 5, quantity will be 14 and profits would be 5x14-2x14-0.05x142= 32.2

5) A shop sells skate rollers and organizes courses to teach skaters how to use them. The table below reports the willingnesses to pay for the skate rollers and for the course.

|  |  |  |
| --- | --- | --- |
| Consumers | Roller | Course |
| A | 85 | 5 |
| B | 80 | 50 |
| C | 55 | 70 |
| D | 10 | 100 |

Find the optimal solutions in the following three cases: no bundling, pure bundling, mixed bundling.

In the case of no bundling, rollers are sold at 55 and the course is offered at 50, so total revenues (profits in this case) are equal to 315. In the case of pure bundling, a package Roller+course can be sold at 90. Profits will be 360. In the case of mixed bundling, the package can be sold at 125, while the rollers are sold separately at 85 and the course at 100. Total profits will be 250+185=435.

6) Illustrate two factors that can facilitate collusion and two factors that can make it harder for firms to collude.