IOA Exam 2022

EXAM pin: 22208

1. Multiple Choice

Question	Answer
1	A
2	A
3	D
4	A
5	D
6	C
7	A

2. Long question A

a)

$$q_1 = v_1 - 0{,}5v_2 - p_1 + 0{,}5p_2$$

$$q_2 = v_2 - 0{,}5v_1 - p_2 + 0{,}5p_1$$

We set up the profit function

$$\pi_1 = p_1(v_1 - 0{,}5v_2 - p_1 + 0{,}5p_2) - c_1(v_1 - 0{,}5v_2 - p_1 + 0{,}5p_2)$$

$$\pi_1 = p_1(1 - 0{,}5(1) - p_1 + 0{,}5(0{,}3)) - 0{,}25(1 - 0{,}5(1) - p_1 + 0{,}5(0{,}3))$$

$$\pi_1 = p_1(1 - 0{,}5 - p_1 + 0{,}15) - 0{,}25(1 - 0{,}5 - p_1 + 0{,}15)$$

$$\pi_1 = p_1(0{,}65 - p_1) - 0{,}25(0{,}65 - p_1)$$

$$\pi_1 = 0{,}65p_1 - p_1^2 - 0{,}1625 + 0{,}25p_1$$

$$\frac{d\pi_1}{dp_1} = 0{,}65 - 2p_1 + 0{,}25 = 0$$

$$0{,}9 = 2p_1$$

$$p_1 = 0{,}45$$

To conclude, the profit maximizing price for firm 1 is $\boldsymbol{p_1 = 0,45}$

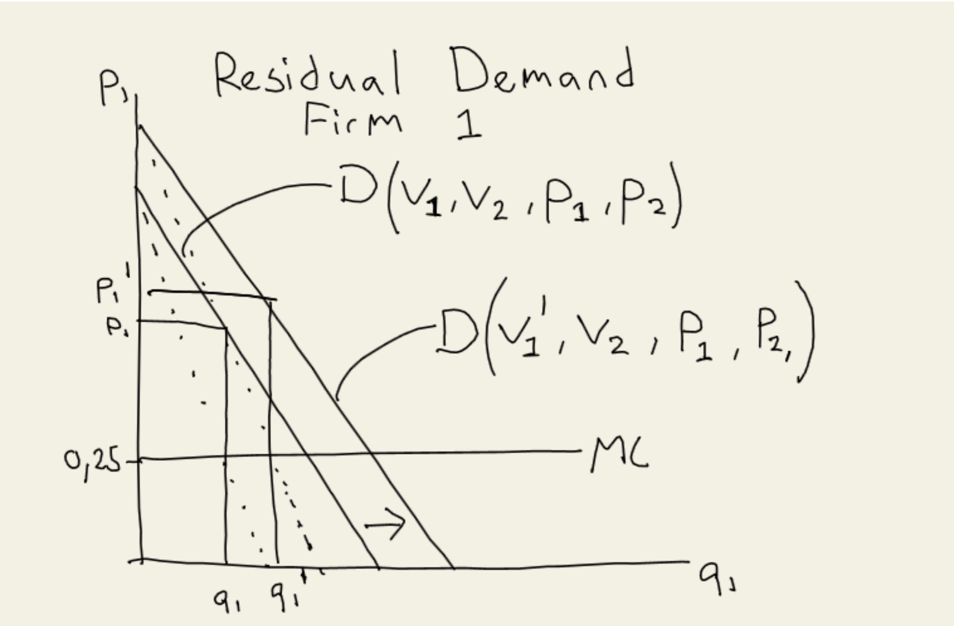
$$\pi_1 = 0{,}45(1 - 0{,}5(1) - 0{,}45 + 0{,}5(0{,}3)) - 0{,}25(1 - 0{,}5(1) - 0{,}45 + 0{,}5(0{,}3))$$

$$\pi_1 = 0{,}45(0{,}2) - 0{,}25(0{,}2)$$

$$\pi_1 = 0{,}09 - 0{,}05$$

$$\boldsymbol{\pi_1 = 0,04}$$

b)



As we can see from the illustration, increasing the quality of firm 1 while keeping the quality at firm 2 the same, would result in a larger demand for firm 1's product. This shifts the residual demand to the right. This means that Firm 1 can now charge more for its improved product and thus will be able to get higher prices and higher quantities. The residual demand for firm 2 would shift in the opposite direction (not illustrated).

c)

Simplifying the demand functions we get:

$$q_1 = k_1 - p_1 + 0{,}5p_2$$

$$q_2 = k_2 - p_2 + 0{,}5p_1$$

First we find the best response for firm 1.

$$\pi_1 = p_1(k_1 - p_1 + 0{,}5p_2) - c_1(k_1 - p_1 + 0{,}5p_2)$$

$$\pi_1 = p_1k_1 - p_1^2 + 0{,}5p_1p_2 - c_1k_1 + c_1p_1 - 0{,}5c_1p_2$$

$$\frac{d\pi_1}{dp_1} = k_1 - 2p_1 + 0{,}5p_2 + c_1 = 0$$

$$2p_1 = k_1 + 0{,}5p_2 + c_1$$

$$p_1 = \frac{k_1 + c_1}{2} + 0{,}25p_2$$

Since we know that the firms are symmetric, we can easily derive the best response function for firm 2:

$$p_2 = \frac{k_1 + c_2}{2} + 0{,}25p_1$$

To conclude, the best response functions are $\boldsymbol{p_1 = \frac{k_1+c_1}{2} + 0,25p_2}$ and $\boldsymbol{p_2 = \frac{k_1+c_1}{2} + 0,25p_1}$

d)

Assuming $v_1 = v_2 = v$ that means that:

$$k_1 = k_2 = v - 0{,}5v = 0{,}5v$$

When $v_1 = v_2$ the nash equilibrium prices for both firms will be:

$$p_1 = \frac{0{,}5v + c_1}{2} + 0{,}25p_2$$

$$p_2 = \frac{0{,}5v + c_2}{2} + 0{,}25p_1$$

In the case where $v_1 = v_2 = 1$ then the best response for firm 1 will be:

$$p_1 = \frac{0{,}5(1) + 0{,}25}{2} + 0{,}25p_2$$

$$p_1 = 0{,}375 + 0{,}25p_2$$

Since firms are symmetric the best response for firm 2 will be:

$$p_2 = 0{,}375 + 0{,}25p_1$$

Now, to find the Nash equilibrium prices and profits, we insert one best response into the other.

$$p_1 = 0{,}375 + 0{,}25(0{,}375 + 0{,}25p_1)$$

$$p_1 = 0{,}375 + 0{,}09375 + \frac{1}{16}p_1$$

$$\frac{15}{16}p_1 = 0{,}46875$$

$$\boldsymbol{p_1 = 0,5}$$

Now we know that firm 1 sets prices at $p_1 = 0{,}5$. We insert this price into firm 2's best response.

$$p_2 = 0{,}375 + 0{,}25(0{,}5)$$

$$\boldsymbol{p_2 = 0,5}$$

Now we can conclude that both firms, given a quality of $v = 1$ will set prices at 0,5.

We can use these prices to calculate the profits:

$$\pi_1 = (0{,}5v - p_1 + 0{,}5p_2)p_1 - c_1(0{,}5v - p_1 + 0{,}5p_2)$$

$$\pi_1 = (0{,}5(1) - 0{,}5 + 0{,}5(0{,}5))0{,}5 - 0{,}25(0{,}5(1) - 0{,}5 + 0{,}5(0{,}5))$$

$$\pi_1 = (0{,}25)0{,}5 - 0{,}25(0{,}25) = 0{,}25^2$$

$$\boldsymbol{\pi_1 = 0,0625}$$

Because firms are symmetric, have same quality and same costs, we know they make equal profits

Thus, we can conclude that the NE prices are $p_1 = \frac{0,5v+c_1}{2} + 0,25p_2$ and $p_2 = \frac{0,5v+c_2}{2} + 0,25p_1$. This means that for a quality level of $v = 1$ each firm will set prices at $p_1 = p_2 = 0,5$ and make profits of $\pi_1 = \pi_2 = 0,0625$ each.

e)

Once again we assume that $v_1 = v_2 = 1$. We use the same simplified BR's from before:

$$p_1 = 0{,}375 + 0{,}25p_2$$

$$p_2 = 0{,}375 + 0{,}25p_1$$

Since firm 1 sets its price first, we are talking about a sequential game. Here we insert the followers best response into the leader's profit function.

$$\pi_1 = (p_1 - 0{,}25)(0{,}5 - p_1 + 0{,}5p_2)$$

$$\pi_1 = (p_1 - 0{,}25)(0{,}5 - p_1 + 0{,}5(0{,}375 + 0{,}25p_1))$$

$$\pi_1 = (p_1 - 0{,}25)(0{,}5 - p_1 + 0{,}1875 + 0{,}125p_1)$$

$$\pi_1 = (p_1 - 0{,}25)(0{,}6875 - 0{,}8125p_1)$$

$$\pi_1 = 0{,}6875p_1 - 0{,}25(0{,}6875) - 0{,}8125p_1^2 + 0{,}25(0{,}8125p_1)$$

$$\frac{d\pi_1}{dp_1} = 0{,}6875 - 2(0{,}8125p_1) + 0{,}25(0{,}8125) = 0$$

$$0{,}6875 + 0{,}203125 = 1{,}625p_1$$

$$1{,}625p_1 = 0{,}890625$$

$$\boldsymbol{p_1 = 0,548}$$

Now we know what firm 1 will price.

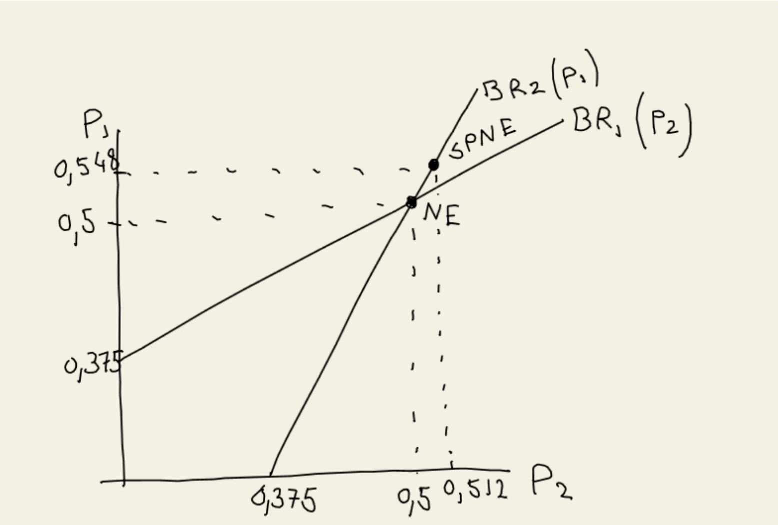
We now insert this price in firm 2's best response.

$$p_2 = 0{,}375 + 0{,}25(0{,}548)$$

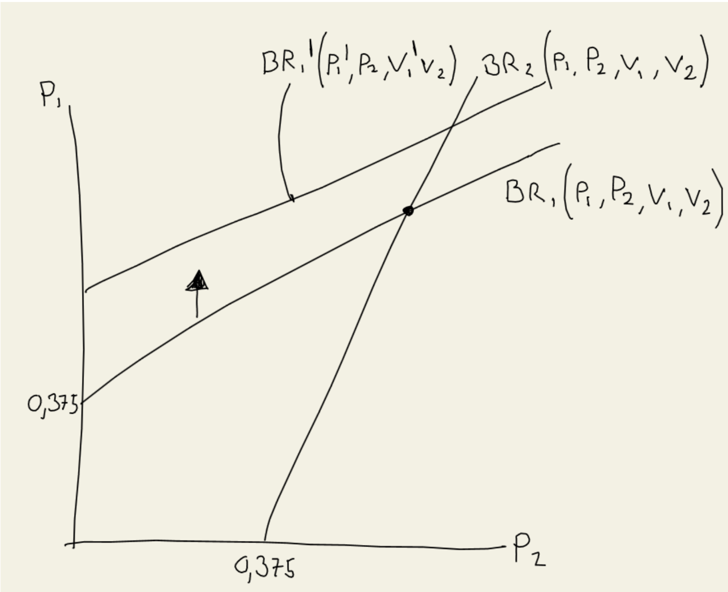
$$\boldsymbol{p_2 = 0,512}$$

So to conclude, for the case where $v_1 = v_2 = 1$ firm 1 will price at $p_1 = 0,548$ and firm 2 will price at $p_2 = 0,512$

f)



Above you see the case where the quality levels were equal at $v_1 = v_2 = 1$. Here, the NE is where both firms price at 0,5. The SPNE can be seen on firm 2's best response line. Here, Firm 1 moves first and sets a price of 0,548, where firm 2 then undercuts by setting price at 0,512. Since the costs and qualities are equal, firm 2 has a late mover advantage



In the picture above you see what happens when firm 1 increases its quality. Increasing the vertical differentiation will shift it's price upwards (we know this because when v_1 goes up and v_2 stays the same → k_1 goes up).

Before the quality levels were the same thus $k_1 = k_2 = 0{,}5$

$$k_1' = 1.25 - 0{,}5(1) = 0{,}75 \uparrow$$

$$k_2' = 1 - 0{,}5(1{,}25) = 0{,}375 \downarrow$$

Because k_1 is in the numerator of the best response function, the price will increase, and shift BR1 upwards. I have not chosen to shift the BR function for firm 2, since I would argue the change is

ambiguous. While the price of the competitor firm pushes it's price up, the lower k_1' shifts it in the other direction. Since we were not asked to do any calculations regarding the quality increase, I have just shown it graphically.

3. Long questions B

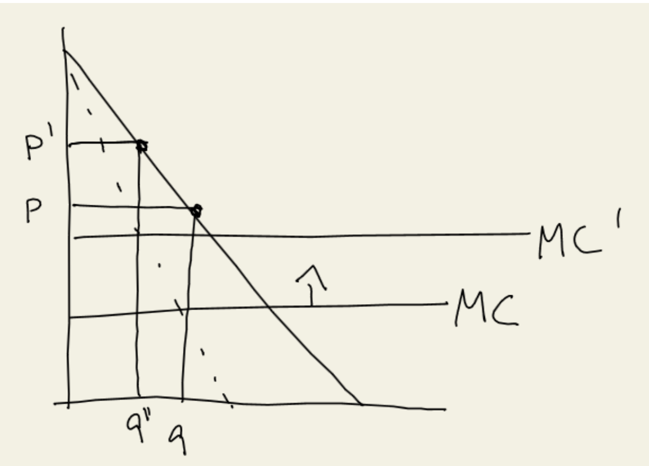
1)

Pet foods can be differentiated vertically by the respective quality levels of the products. It is mentioned in the article that consumer's increasingly demand high quality food products, with 79% saying that pet food is just as important as their own. But how can they differentiate themselves on quality?

1. One of the characteristics they can use to differentiate themselves among consumers is additives. Fewer added synthetic tastes should be desirable to the consumers, who are predominantly millennials. Here an example could be gene-modified versus organic.
2. Another one would be nutrition. Since the young segment is becoming increasingly aware of what they eat, they pass this onto their pets. Thus, all else equal, the better nutrition there is in the product, the more desirable it should be (and the higher the willingness to pay). Here an example could be a product specifically designed for active lifestyle of dogs, versus a product based on fat high calories.

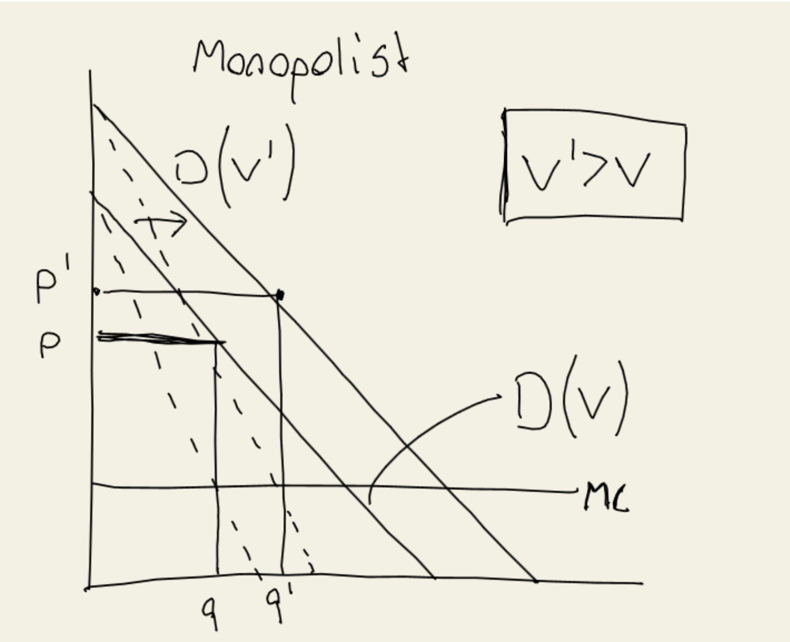
2)

The spiraling costs thanks to the Covid-pandemic is an issue for the firms. As seen below, increased costs, shift the marginal cost curve upwards which reduces the firms margins. Knowing the market structure as being not perfectly competitive (since the top 3 firms are having very high market shares), I have drawn a residual demand curve for a given producer.



As we can see, because the cost increases, the new profit maximization point is producing at a higher price and selling less. Since the new rectangle is smaller than the old one, we can also conclude that profits will be lower. If we assume all firms are hit by these price increases equally, then overall the industry profits should go down, and the industry prices should go up. This will further boost inflation in society.

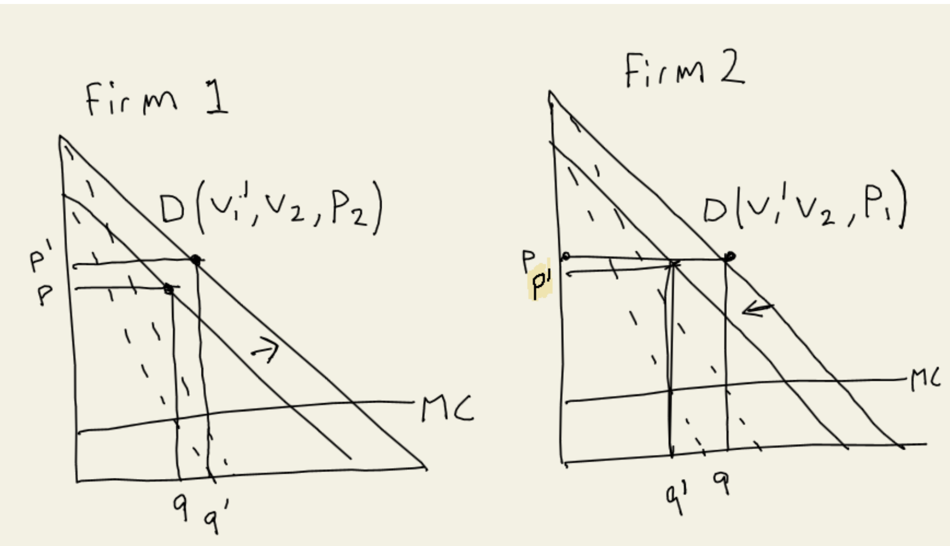
3)



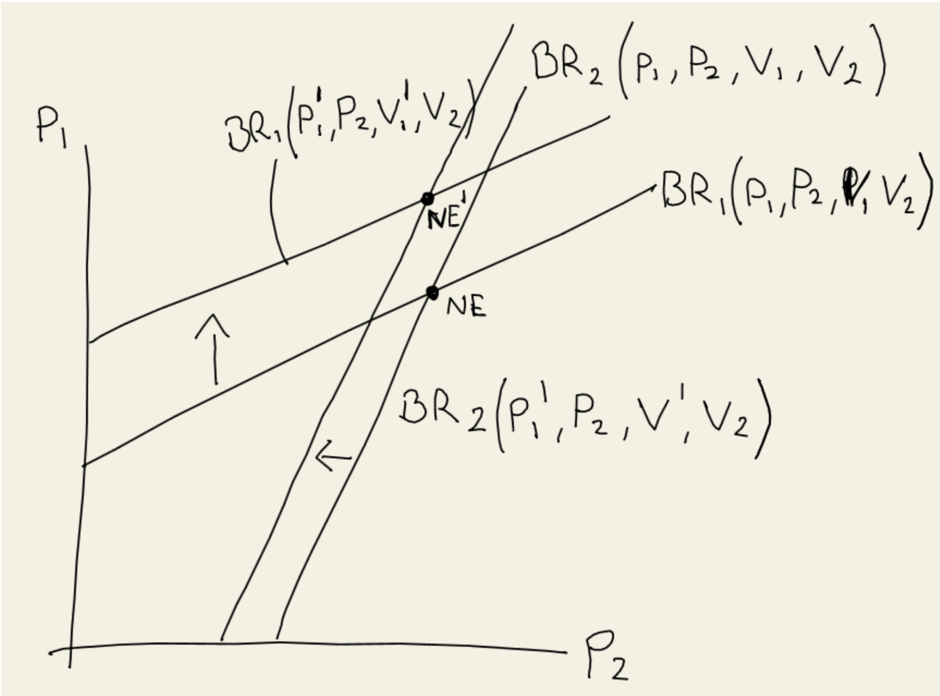
Assuming there is only one firm in the market, I have drawn the demand curve for a monopolist. Because the consumers increasingly demand high quality products, I expect the demand to shift to the right, as the firm increases its quality from $v \rightarrow v'$. This leads to both higher prices and higher quantities sold. All in all profits increase a great amount. However, please note that I have assumed that the marginal costs remain unchanged. This is because I assume that the improvement of quality lies in Fixed costs, F, which do not translate over to marginal cost. Profits might very well be lower than described in the illustration, and it is up for the firm to decide wether or not the higher price and quantity makes it worthwhile.

4)

The effect on firms profits very well depend on how the two firms are positioned on the vertical differentiation line. When firm 1 increases it's quality, the consumer demand increases and its residual demand shifts to the right. This leads to increased profits for firm 1.



On the other hand, firm 2's residual demand shifts to the left, as less people want their product now. This leads to lower prices, quantities and profits for firm 2.

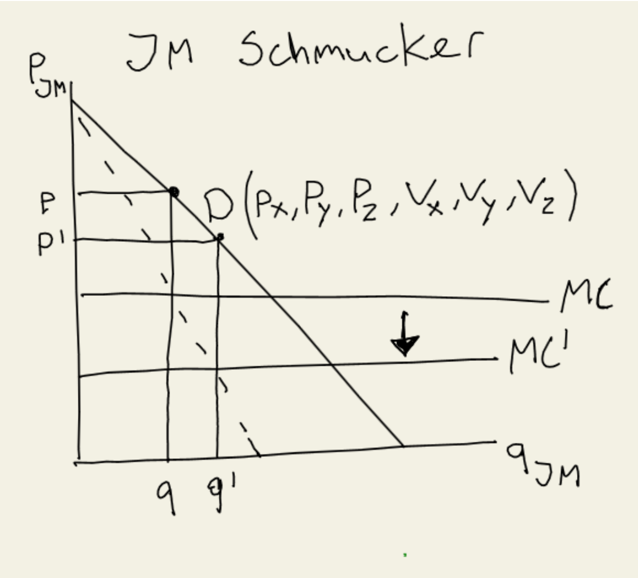


Looking at the best response functions, we see that firm 1's best response functions shifts up as a result of their higher quality. Firm 2's best response shifts to the left, which in turns means that the Nash Equilibrium prices goes up for firm1, and goes a little lower for firm 2. Firm 1 should see higher profits and firm 2 should see less profits (if we assume their residual demand curve shifts to the left).

5)

As mentioned in the article the mergers and acquisitions within the pet food industry has several synergy effects. First of all, it allows for lower costs, since they can use the same ingredients. This is especially apparent in the case for JM Schmucker, which used to sell packaged goods for humans. Because a lot of the ingredients used in pet food come from rest products from human food production, this should give notable cost savings.

Another synergy effect would be in terms of distribution. They are sold in the same stores, so distributing the new product could use the same distribution channels that are already set up. This leads to a lower fixed costs/unit ratio. Overall this should decrease Average Cost. Likewise could economies of scale, with the increased production output from the mergers, further reduce costs.



Looking at the residual demand curve, it shows the effects quite well. By receiving reduced marginal costs, the firm is able to lower its price and drastically increase it's output. This will overall increase the profits of the acquired firm. Because this was an acquisition from an outside firm, this does not change market concentration much (might slightly increase the market share for JM Schmucker. In terms of the market, because JM Schmucker is now pricing their products lower, the other firms might always want to follow.

6)

GM acquiring has some similarities, but also differences, with the acquisition mentioned above. We can, same as above, assume that there will be synergies related to distribution. However, sine this is a merger, there will also be knowledge transfer which might help them improve their technology and thus reduce production costs. There will likely also be economies of scale (to a greater extent than what was seen with JM Scmhucker). Another side effect of the merger, is the fact that the market will become increasingly concentrated (The herfindahl index will go up). If we assume that there were 4 market players before, now there will only be 3. Because we know that products are vertically differentiated, we can consider that there is a fair possibility of sustaining the aggregate market shares, meaning that the merger paradox might not be as relevant in this situation. Here it could actually be profitable to merge, thanks to all the synergies and differentiation. There might also be horizontal differentiation in terms of brand preferences. Overall, the competition would be less intense and all firms would enjoy higher profits in the less concentrated market (The fewer firms there are also higher likelihood of collusion).

7)

Competition authorities generally have three main purposes. Preventing dominant player abuse, preventing cartels and regulating mergers. In this case the part about mergers is relevant. The main difference between JM Schmucker and GM was that JM Schmucker acquired a firm as means of entering the market, while GM seeks to expand it's market power by merging with a competitor.

In the case of JM Schmucker, there was as mentioned not a great threat to the concentration in the market. Actually, due to the synergy effects, it was calculated that prices would be reduced, which authorities and consumers are very happy about. However, due to the nature of the highly differentiated market of pet foods, the merger between GM and Buffalo would on the opposite hand drastically increase concentration. This would move the market closer to monopoly pricing, and prices would be expected to increase. Because authorities always look at these cases from the consumers perspective, it seems highly probable that they would block the merger between GM and Buffalo. The acquisition between JM Schmucker and Big Hearts would be welcomed.