IBP Applied Microeconomics 2021

Question 1

A)

Demand: $Q_d = 100 - P$

Supply: $Q_s = 4P$

Finding EQ in PC:

$Q_d = Q_s \iff 100 - P = 4P \iff 100 = 5P$

$\iff P^* = 20$

$Q^* = 4 \cdot P^* = 80$

So $\underline{\underline{P^* = 20 \text{ and } Q^* = 80}}$

B)

Finding elasticity of demand:

$$\varepsilon_d = \frac{\partial Q}{\partial P} \cdot \frac{P}{Q}$$

We know that $Q = 80$ and $P = 20$.

$$\frac{\partial Q}{\partial P} = -1$$

$$\varepsilon_d = -1 \cdot \frac{20}{80} = -0{,}25$$

So $\underline{\underline{\varepsilon_d = -0{,}25}}$

I found that the elasticity of demand at the equilibrium price and quantity is -0.25. This means that when price increases by 1% demand decreases by 0.25%.

C)

Tax of 5 on consumers

Finding inverse demand and supply:

$Q_d = 100 - P \iff P_d = 100 - Q$

$Q_s = 4P \iff P_s = \frac{1}{4}Q$

Imposing tax on consumers:

$P_d + 5 = 100 - Q \iff P_{d+\tau} = 95 - Q$

Finding Q_τ^*:

$P_{d+\tau} = P_s \iff 95 - Q = \frac{1}{4}Q \iff 95 = 1{,}25Q$

$\iff Q_\tau^* = 76$

Finding Price consumers pay:

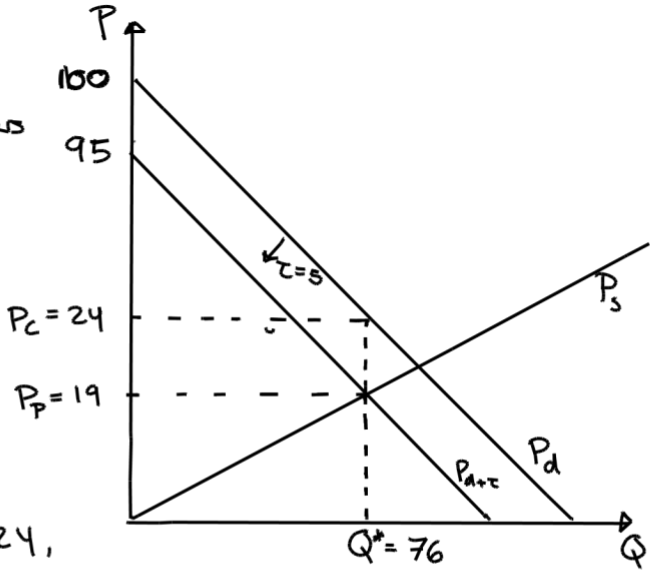
$P_c = 100 - 76 = 24$

Finding Price producers pocket:

$P_p = 95 - 76 = 19$

so $\underline{\underline{Q_\tau^* = 76,\ P_c = 24,}}$

and $\underline{\underline{P_p = 19}}$



D)

Ireland

Demand: $Q_d = \frac{1}{P}$

supply: $Q_s = \frac{1}{4} \cdot P$

Finding Q^* and P^*:

$Q_d = Q_s \iff \frac{1}{P} = \frac{1}{4} P \iff \frac{4}{P} = P$

$\iff 4 = P^2 \iff P^* = \sqrt{4} = 2$

$Q^* = \frac{1}{4} \cdot 2 = \frac{1}{2}$

so $\underline{\underline{P^* = 2 \text{ and } Q^* = \frac{1}{2}}}$

Finding elasticity of demand

$\varepsilon_d = \frac{\partial Q}{\partial P} \cdot \frac{P}{Q}$

I know that $P = 2$ and $Q = \frac{1}{2}$

$\frac{\partial Q}{\partial P} = \left(\frac{1}{P}\right)' = -\frac{1}{P^2}$

$\varepsilon_d = -\frac{1}{P^2} \cdot \frac{P}{Q} = -\frac{1}{2^2} \cdot \frac{2}{\frac{1}{2}} = -\frac{1}{4} \cdot 4 = -1$

so $\underline{\underline{\varepsilon_d = -1}}$

Here elasticity of demand is -1, which means that when price increases by 1% then demand decreases by 1%.

Question 2

A)

Info:

cost function : $C(q) = 64 + q^2$
$P = 28$ in short run.

Fixed costs: Given the cost function above, the fixed costs (F) in the short run are F = 64.

Optimal number of rides (q*) in short run:

In the short run, firms will produce the optimal output (e.g. give the optimal number of rides) at the point where their marginal costs are equal to their marginal revenue. In perfect competition MR = P as firms are price takers:

Finding marginal costs (MC) :

$MC = \frac{\partial TC}{\partial Q} = (64 + q^2)' = 2q$

I know that $MR = P = 28$

Setting $MC = MR$ and finding q^* :

$MC = MR \iff 2q = 28 \iff \underline{\underline{q^* = 14}}$

Checking for shut down: A firm will produce in the short run if p < AVC (average variable cost). In this case, AVC = $\frac{VVVV}{qq} = qq* = 14$. As 14 > p=28 the driver will drive.

So the short run fixed costs are 64 and the optimal number of cab rides in the short run is 14.

B)

Profit function:

$\pi = (q) = R(q) - TC(q) \iff$
$\pi(q) = (P \cdot q) - (64 + q^2) \iff$
$\pi(q) = (28 \cdot q) - (64 + q^2)$

Profit in the short run:

Inserting $q^* = 14$:

$$\pi(14) = (28 \cdot 14) - (64 + 14^2)$$
$$= 392 - 260 = \underline{\underline{132}}$$

So profit for each driver in the short run is 132.

Will the number of drivers increase, decrease or stay the same in the long run?

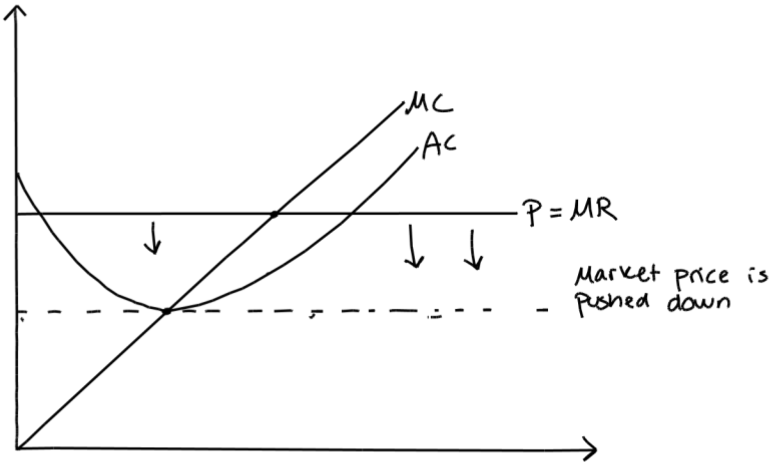
In the long run, the number of cab drivers will increase because profit is greater than zero (132 > 0) and perfect competition allows for drivers to freely enter and exit the market in the long run.

C)

What happens to prices (and why) moving from the short run to the long run?

We have seen that each driver can make a profit in the short run. In the long run, more drivers will keep entering the market as long as there is profit to be made. As more drivers enter, competition drives the market price down until prices reach the minimum point of the drivers' average cost. At this point profit will be zero and new drivers will stop entering the market.

Below is a hypothetical graph that illustrates market price being pushed to the lowest point of the average cost (AC) curve:



Equilibrium price and quantity in the long run for each driver:

Finding AC:

$$AC = \frac{TC}{q} = \frac{64 + q^2}{q} = \frac{64}{q} + q$$

Finding minimum of AC-curve:

$$\frac{\partial AC}{\partial q} = 0$$

$$\frac{\partial AC}{\partial q} = -\frac{1}{q^2} \cdot 64 + 1 = -\frac{64}{q^2} + 1$$

$$\frac{\partial AC}{\partial q} = 0 \iff -\frac{64}{q^2} + 1 = 0 \iff 1 = \frac{64}{q^2} \iff$$

$$q^2 = 64 \iff \underline{\underline{q^*_{LR} = 8}}$$

Finding P^*_{LR}

$$P^*_{LR} = AC(q=8) = \frac{64}{8} + 8 = 8 + 8 = 16 \iff$$

$$\underline{\underline{P^*_{LR} = 16}}$$

So in the long run the equilibrium price is 16 and the equilibrium quantity is 8.

D)

Number of driver in the long run:

Total demand in a market (Q*) is served by *n* number of firms each supplying q*:

$$Q^* = n \cdot q^*$$

we know that $q^*_{LR} = 8$ and $P^*_{LR} = 16$

Finding Q^*_{LR} given market demand function $(Q = 96 - P)$:

$$Q^*_{LR} = 96 - 16 = 80$$

$$Q^* = n \cdot q^* \iff 80 = n \cdot 8 \iff$$

$$\underline{\underline{n = 10}}$$

So there will be 10 driver in the long run.

Profit for each driver in the long run:

$$\pi(q) = R(q) - C(q) \iff$$

$$\pi(q=8, P=16) = (16 \cdot 8) - (64 + 8^2) = 128 - 128$$

$$\iff \underline{\underline{\pi(q=8, P=16) = 0}}$$

So long run profit for each driver is 0.

E)

Are drivers in round 3 making a profit or a loss?

In round 3 the drivers are making a loss as the number of drivers in the market (n=7) exceeds the equilibrium number of drivers in the long run (n*=6).

Why does the number of drivers fall in round 4?

In round 4 the number of drivers fall because drivers experienced making a loss in round 3.

Therefore, some drivers decided to exit the market to avoid a loss.

Are drivers in round 4 making a profit or a loss?

The driver in round 4 are making a profit because the number of driver in the market (n=3) exceeds the equilibrium number of drivers in the long run (n*=6).

Why does the number of drivers rise again in round 5?

As there was profit to make in round 4, other drivers see this and wish to enter the market to capture profit and thus the number of driver rise.

Question 3

A)

Finding Nash Equilibria in pure strategies

		Carl	
		Attacu	Retreat
Rob	Attack	-5 , -5	10 , 0
	Retreat	0 , 10	9 , 9

There are 2 Nash Equilibria in pure strategies: (Retreat; Attack) and (Attack; Retreat)

B)

Calculating mixed strategy Nash equilibrium:

		Camilla p	(1-P)
		Deer	Rabbit
Rebecca	q Deer	4 , 4	0 , 2
	(1-q) Rabbit	2 , 0	1 , 1

Camilla want to choose deer and rabbit with probabilities (respectively) p and (1-p) such that Rebecca becomes indifferent between choosing deer or rabbit. Thus Camilla wants to set p such that: $EV_R(D) = EV_R(R)$

Finding $EV_R(D)$ and $EV_R(R)$:

$EV_R(D) = p \cdot 4 + (1-p) \cdot 0 = 4p + 0 = 4p$

$EV_R(R) = p \cdot 2 + (1-p) \cdot 1 = 2p + 1 - p = p + 1$

$EV_R(D) = EV_R(R) \iff 4p = p + 1 \iff$

$3p = 1 \iff \underline{p = \frac{1}{3}}$

Thus $(1-p) = 1 - \frac{1}{3} = \underline{\frac{2}{3}}$

Likewise, Rebecca want to set q such that: $EV_C(D) = EV_C(R)$

Finding $EV_C(D)$ and $EV_C(R)$:

$EV_C(D) = q \cdot 4 + (1-q) \cdot 0 = 4q$

$EV_C(R) = q \cdot 2 + (1-q) \cdot 1 = 2q + 1 - q = q + 1$

$EV_C(D) = EV_C(R) \iff 4q = q + 1 \iff$

$3q = 1 \iff \underline{q = \frac{1}{3}}$

Thus $\underline{(1-q) = \frac{2}{3}}$

So the mixed strategies equilibrium is:

$$\underline{\underline{\left[\left(p = \frac{1}{3} ;\ (1-p) = \frac{2}{3} \right) ;\ \left(q = \frac{1}{3} ;\ (1-q) = \frac{2}{3} \right) \right]}}$$

C)

Camilla knows that Rebecca has a higher payoff from hunting deer than rabbits if Camilla also hunts deer. This means that IF Camilla hunted deer and rabbit with a 50-50 probability, then Rebecca's expected value of hunting deer would be greater than Rebecca's expected value of hunting rabbits. In a mixed strategy Nash equilibrium the goal is to make your opponent indifferent between their choices. Thus Camilla must hunt deer less often than rabbit in a way that makes Rebecca indifferent between hunting deer or rabbit.

D)

Expected value of lottery:

$$EV = \frac{1}{2} \cdot 0 + \frac{1}{2} \cdot 200 = 100$$

so $\underline{\underline{EV = 100}}$

Francis' expected utility of lottery:

$$EU_F = \frac{1}{2} \cdot (0)^2 + \frac{1}{2} \cdot (200)^2 = \frac{1}{2} \cdot 40000$$

$$= 20000$$

so $\underline{\underline{EU_F = 20\,000}}$

Will Francis sell?

Finding Francis' certainty equivalent (CE) which shows the amount Francis is willing to accept for the ticket:

$$CE^2 = EU_F \iff CE = \sqrt{20000} \iff$$

$$CE = 141{,}4$$

This means that Francis is willing to accept 141.4 DKK for the ticket. As 130 DKK < 141.4 DKK, <u>Francis will NOT sell the ticket to John.</u>

E)

Finding Laura's expected utility:

$$EU_L = \frac{1}{2} \cdot 10 \cdot Y + \frac{1}{2} \cdot 10 \cdot 200 = 1000$$

$$\text{so } \underline{\underline{EU_L = 1000}}$$

Finding Laura's certainty equivalent:

$$CE_L \cdot 10 = EU_L \iff CE_L = \frac{EU_L}{10} \iff$$

$$CE_L = \frac{1000}{10} \iff \underline{\underline{CE_L = 100}}$$

Is it optimal for John to offer Laura 130 DKK for the ticket?

Laura's certainty equivalent reflects the amount of money she is willing to accept in exchange for the lottery ticket. <u>As Laura is willing to accept 100 DKK, it is NOT optimal for John to offer 130.</u>