Part 1

Question	Answer
1	A
2	B
3	B
4	A
5	C
6	B
7	A
8	D
9	C
10	D
11	D
12	C
13	B
14	B
15	A
16	A
17	A
18	C
19	A
20	B

Part 2

I answered question 2 and 3.

2. Supply side

The market for baguettes is perfect competition. In the short run Babette's Baguettes has

TC = $32 + 2q^2$

a) To find the minimum price, where the firm earns nonnegative profits we have to use the profit function and set that equal to zero. Meaning we have to find where TR = TC.
$TR = p * q$
$\pi = p * q - 32 - 2q^2$

From perfect competition we know: P = MC
$MC = 4q = p$
$\pi = 0$
$4q * q - 32 - 2q^2 = 0$
$32 = 4 - 2q^2$
$32 = 2q^2$

$16 = q^2$
$q = 4$
$p = 4 * 4 = 16$

The minimum price for nonnegative profits will be: 16

b) With number of firms n = 400, we now wish to derive the supply function.
We can find the optimal output by setting p = mc. This was done before. P = 4q. So that means q = $\frac{1}{4}p$. This is used to derive the supply function.
$Q_s = 400 * \frac{1}{4}p$
$\boldsymbol{Q_s = 100p}$

c) For this part we have moved into the long run. All firms have the following cost cure:
$TC = q^3 - 16q^2 + 109q$
The long run equilibrium price is found when MC = AC. Because in the long run P = AC.
$AC = q^2 - 16q + 109$
$MC = 3q^2 - 32q + 109$

$MC = AC$
$3q^2 - 32q + 109 = q^2 - 16q + 109$
$2q^2 = 16q$
$2q = 16$
$q = 8$
This q = 8 is inserted into AC to find p.
$AC = 8^2 - 16 * 8 + 109 = 45$
Which therefore means:
P = 45
The long run equilibrium price will be 45.

d) Now the market demand is given:
$Q_D = 2050 - 10p$
To find the number of firms, n. There exists this correlation: n*q = Q.
We can therefore use the numbers from the previous assignment:
$P = 45\ AND\ q = 8$

By isolating n we get:
$n = \frac{Q}{q} = \frac{(2050 - 10 * 45)}{8} = 200$
There will be 200 firms.

This is the calculation of the firms in the long run with the given demand function, but it must be mentioned that the number of firms is not fixed in the long-run.

e) Why is Babette not increasing her price? Should she exit the market and do something else?

In the long run profit = 0. This happens because the price is set at P = MC = AC. That means Babette cannot increase her price, because the consumers would just find another supplier. Therefore, Babette should not exit the market, she should exit the market if she were making negative profits.

3. Monopolies, duopolies and game theory.

There exists a monopoly for pretzels in this small town in Germany. Peter is the supplier and he faces this inverse demand function and this cost function:
$P = 180 - 2Q$
$C = q^2 + 90q$

a) First P and Q will be determined, and hereafter the Deadweight loss will be calculated.
In a monopoly the optimal price and quantity is found at MR = MC. Therefore, these will be calculated and put equal to each other.
$MR = 180 - 4Q$
$MC = 2q + 90$

$MR = MC$
$180 - 4Q = 2q + 90$
$90 = 6Q$
$15 = Q$

$P = 180 - 2 * 15 = 150$

The price is 150 and the quantity is 15.

To calculate the Deadweight loss, we need the price and the quantity from as if it were a competitive market. This is found at P = MC:
$P = MC$
$180 - 2Q = 2q + 90$
$90 = 4Q$
$22{,}5 = Q$
$P = 190 - 2 * 22{,}5 = 135$

The Deadweight loss can now be calculated as such:
$(150 - 135) * (22{,}5 - 15) * \frac{1}{2} = 15 * 7{,}5 * \frac{1}{2} = 56{,}25$

The Deadweight loss caused by the monopoly is 56,25.

b) Now it becomes a duopoly because Alicia enters the market.
Peters demand function:
$q_p = 420 - 2p_p + p_A$
Alicia's demand function:
$q_A = 420 - 2p_a + p_p$

Their AC =0.

Now we will find how much they produce and what price they set. We will do so using the Bertrand model, because they simultaneously choose their price.
First the best-response functions will be found. This is done by finding their profit functions:

$$\pi_p(p_p) = p_p * q_p - AC_p * q_p = (p_p - AC_p) * q_p$$

$$\pi_p(p_p) = (p_P - 0) * q_P$$

The marginal profit $\frac{\Delta\pi}{\Delta p_p}$ needs to be found. When we derive a function h(x)=f(x)g(x), then h'(x) = f'(x)g(x) + f(x)g'(x). Therefore:

$$\frac{\Delta\pi}{\Delta p_p} = \mathrm{q_p} + (p_p - AC) * \frac{\Delta q_p}{\Delta p_p}$$

Now the function for q_p is put in:

$$\frac{\Delta\pi}{\Delta p_p} = 420 - 2p_p + p_A + (p_P - 0) * -2$$

$$\frac{\Delta\pi}{\Delta p_p} = 420 - 2p_p + p_A - 2p_p$$

$$4p_p = 420 + p_A$$

$$p_p = 105 + \frac{1}{4}p_A$$

Because the demand functions are complete opposites in regard to the P_p and P_A, the best response function for P_A is:

$$p_A = 105 + \frac{1}{4}p_P$$

Now the best response function is substituted in:

$$p_A = 105 + \frac{1}{4}(105 + \frac{1}{4}p_A)$$

$$p_A = 105 + 26{,}25 + \frac{1}{16}p_A$$

$$\frac{15}{16}\,p_A = 131{,}25$$

$$p_A = 140$$

$$p_p = 105 + \frac{1}{4} * 140 = 140$$

$$q_p = 420 - 2 * 140 + 140 = 280$$

$$q_A = 420 - 2 * 140 + 140 = 280$$

The quantities will both be 280 and the price will be 140.

c) Now we have a change in the demand function, I will not elaborate as much on the steps as they are the same.

$$q_A = 600 - 1{,}5p_A + 1{,}5p_P$$
$$q_P = 200 - 2p_p + 0{,}5p_A$$

The proft function:

$$\pi_p(p_p) = (p_P - 0) * q_P$$

The marginal profit:

$$\frac{\Delta\pi}{\Delta p_p} = \mathrm{q_p} + (p_p - 0) * \frac{\Delta q_P}{\Delta p_p}$$

Putting in the demand function:

$$\frac{\Delta\pi}{\Delta p_p} = 200 - 2\mathrm{p_p} + \frac{1}{2}\, p_A + (p_p - 0) * -2$$

$$\frac{\Delta\pi}{\Delta p_p} = 200 - 4p_p + \frac{1}{2}p_A$$

$$4p_P = 200 + \frac{1}{2}p_A$$

$$p_p = 50 + \frac{1}{8}p_A$$

Now for Alicia:

$$\frac{\Delta\pi}{\Delta p_p} = 600 - 1{,}5p_A + 1{,}5p_P + (p_a - 0) * -1{,}5$$

$$\frac{\Delta\pi}{\Delta p_p} = 600 - 3p_A + 1{,}5p_P$$

$$3p_A = 600 + 1{,}5p_P$$

$$p_A = 200 + \frac{1}{2}p_P$$

Now Peter's best response function is substituted in:

$$p_A = 200 + \frac{1}{2}(50 + \frac{1}{8}p_A)$$

$$p_A = 200 + 25 + \frac{1}{16}p_A$$

$$\frac{15}{16}p_A = 225$$

$$p_A = 240$$

The found price is put into Peters best response function.

$$p_p = 50 + \frac{1}{8} * 240 = 80$$

$$q_A = 600 - 1{,}5 * 240 + 1{,}5 * 80 = 360$$

$$q_P = 200 - 2 * 80 + 0{,}5 * 240 = 160$$

Peter will sell 160 at a price of 80.
Alicia will sell 360 at a price of 240.

d) First the table will be inserted. The best responses will be highlighted with bold and an extra size.

Alicia/Peter	No seating	Seating
No seating	**2**,0	1,**2**
Seating	0,**7**	**6**,6

The mixed strategy equilibrium.
We will calculate the probabilities of Peter choosing seating. Hereafter we will calculate the probabilities of Alicia choosing seating.

The probability of Peter choosing seating:

Alicia's expected payoff when she is choosing no seating:

$\theta_{PS} * 2 + (1 - \theta_{PS}) * 1$
Alicia's expected payoff when she is choosing seating:

$\theta_{PS} * 0 + (1 - \theta_{PS}) * 6$

Now these are put equal to each other.
$\theta_{PS} * 2 + (1 - \theta_{PS}) * 1 = \theta_{PS} * 0 + (1 - \theta_{PS}) * 6$
$2\theta_{PS} + 1 - \theta_{PS} = 6 - 6\theta_{PS}$
$7\theta_{PS} = 5$
$\theta_{PS} = \frac{5}{7}$

The probability of Peter choosing seating is: $\frac{5}{7}$

Now for Alicia:
The probability for Alicia choosing seating:
Peter's expected pay off when he is not choosing seating:
$\theta_{AS} * 0 + (1 - \theta_{AS}) * 7$
Peter's expected payoff when he is choosing seating:
$\theta_{AS} * 2 + (1 - \theta_{AS}) * 6$

Now these are put equal to each other.
$\theta_{AS} * 0 + (1 - \theta_{AS}) * 7 = \theta_{AS} * 2 + (1 - \theta_{AS}) * 6$
$7 - 7\theta_{AS} = 2\theta_{AS} + 6 - 6\theta_{AS}$
$1 = 3\theta_{AS}$

$\frac{1}{3} = \theta_{AS}$

The probability of Alicia choosing seating is: $\frac{1}{3}$