Multiple Choice

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

1. Demand Side

a. The marginal utility for espresso can be found by:

$$MU_E = \frac{\delta U}{\delta E} = 20 - 2E$$

So, when you change the utility by one espresso, the utility function changes $20 - 2E$

The MRS can be found by dividing one marginal utility with the other

$$MRS = -\frac{MU_E}{MU_C} = -\frac{20 - 2E}{80 - 4C}$$

MRS tells us how many espressos she is willing to give up to receive one candy bar. If she had one candy bar and one espresso she would give up 0.237 espresso to receive one candy bar, which intuitively means that she values the espressos higher.

b. The Lagrangian for utility is defined by:

$$\mathcal{L} = U(q_1, q_2) + \lambda(\bar{Y} - p_1q_1 - p_2q_2)$$

So, Fie's Lagrangian is defined by:

$$\mathcal{L} = 20E + 80C - E^2 - 2C^2 + \lambda(41 - E - 2C)$$

The first order conditions are:

$$\frac{\delta \mathcal{L}}{\delta E} = 20 - 2E - \lambda = 0$$

$$\frac{\delta \mathcal{L}}{\delta C} = 80 - 4C - 2\lambda = 0$$

$$\frac{\delta \mathcal{L}}{\delta \lambda} = 41 - E - 2C = 0$$

c. By first isolating the two first order conditions we find Lambda:

$$\frac{\delta \mathcal{L}}{\delta E} = 20 - 2E - \lambda = 0$$

$$\lambda = 20 - 2E$$

$$\frac{\delta \mathcal{L}}{\delta C} = 80 - 4C - 2\lambda = 0$$

$$2\lambda = 80 - 4C$$

$$\lambda = 40 - 2c$$

Then we set lambda equal to lambda and isolate for either variable:

$$40 - 2C = 20 - 2E$$

$$20 - 2C = -2E$$

$$-10 + C = E$$

We then enter it into the budget constraint and solve for C:

$$41 - (C - 10) - 2C = 0$$

$$51 = 3C$$

$$C = 17$$

We then enter the C value into the budget constraint:

$$41 - E - 2(17) = 0$$

$$41 - 34 = E$$

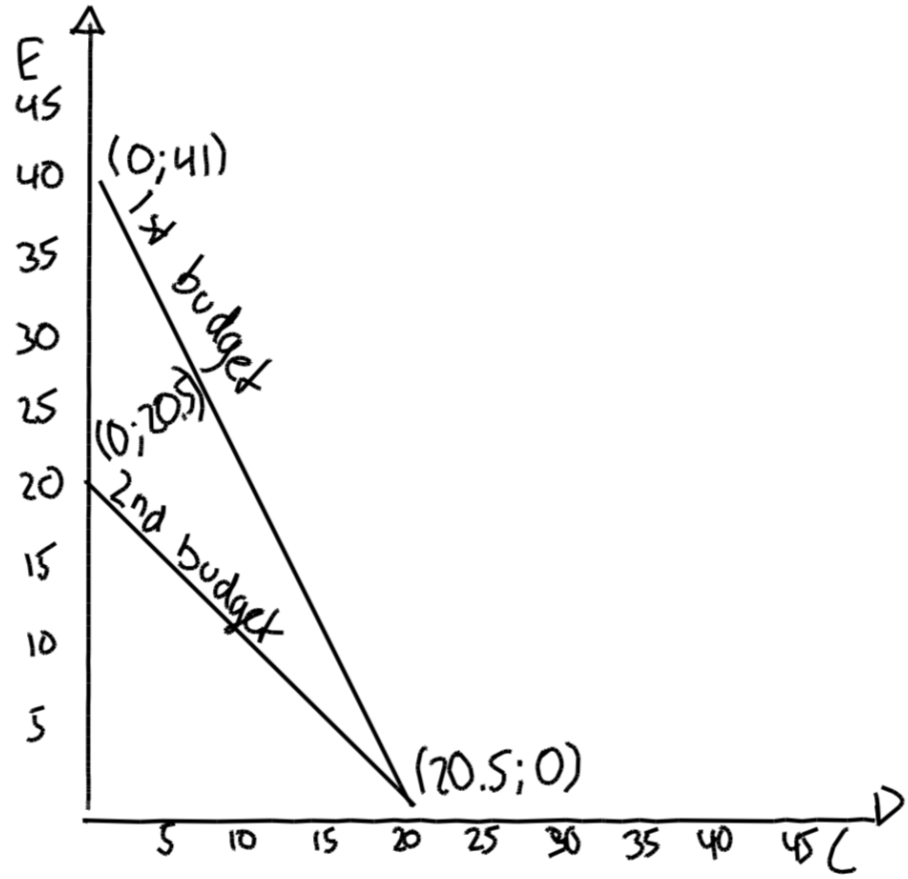
$$E = 7$$

Fie's optimal consumption is thus 17 pieces of candy and 7 espressos. We can then plug these values into her utility function:

$$U(C,E) = 20(7) + 80(17) - (7)^2 - 2(17)^2 = 140 + 1360 - 49 - 578 = 873$$

Her utility is thereby 873.

d.



As can be seen above the second budget constraint moves down the y axis so that the slope and intercept of the budget constraint changes. The Y intercept thus goes from 41 to 20.5 which is the new amount of espressos she would be able to afford if she used all her money on espressos.

To find her new optimal consumption we can recalculate the Lagrangian:

Fie's new Lagrangian is defined by:

$$\mathcal{L} = 20E + 80C - E^2 - 2C^2 + \lambda(41 - 2E - 2C)$$

The first order conditions are:

$$\frac{\delta \mathcal{L}}{\delta E} = 20 - 2E - 2\lambda = 0$$

$$\frac{\delta \mathcal{L}}{\delta C} = 80 - 4C - 2\lambda = 0$$

$$\frac{\delta \mathcal{L}}{\delta \lambda} = 41 - 2E - 2C = 0$$

By first isolating the two first order conditions we find Lambda:

$$\frac{\delta\mathcal{L}}{\delta E} = 20 - 2E - 2\lambda = 0$$
$$20 - 2E = 2\lambda$$
$$\lambda = 10 - E$$
$$\frac{\delta\mathcal{L}}{\delta C} = 80 - 4C - 2\lambda = 0$$
$$2\lambda = 80 - 4C$$
$$\lambda = 40 - 2c$$

Then we set lambda equal to lambda and isolate for either variable:

$$40 - 2C = 10 - E$$
$$30 - 2C = -E$$
$$-30 + 2C = E$$

We then enter it into the budget constraint and solve for C:

$$41 - 2(2C - 30) - 2C = 0$$
$$101 = 6C$$
$$C = 16.833$$

We then enter the C value into the budget constraint:

$$41 - 2E - 2(16.8333) = 0$$
$$7.334 = 2E$$
$$E = 3.66667$$

So, assuming that Fie can consume fractions of candy and espressos per week, she will now consume 16.83333 candy bars and 3.6667 espressos.

e. If she wants to consume 17 candy bars and 7 espressos she would need an income of:

$$Y = 2(7) + 2(17) = 48$$

This means that she would need 48 euros a week to consume the same.

We can exchange this in our budget constraint above and calculate her actual consumption:

$$48 - 2(2C - 30) - 2C = 0$$

$$108 = 6C$$

$$18 = C$$

$$48 - 2E - 2(18) = 0$$

$$12 = 2E$$

$$E = 6$$

Therefore, Fie wouldn't actually consume 16.83 candy bars and 3.667 espressos, but rather 18 candy bars and 6 espressos, which is because this is the new point where she maximizes her utility where MRS = MRT, or in other words where the budget constraint is a tangent to the indifference curve.

2. Supply Side

a. If the firm needs to make a nonnegative profit average variable costs needs to be larger than the price. Since AVC is VC divided by q, AVC needs to be larger than or equal to price.

$$AVC \geq p$$

$$\frac{2q^2}{q} \geq p$$

$$2q \geq p$$

Therefore, the minimum price just has to be equal to 2q in order to generate nonnegative profits in the short run.

Since the optimal quantity is found at MC=AC

$$4q = \frac{32}{q} + 2q$$

$$2q = \frac{32}{q}$$

$$2q^2 = 32$$

$$q^2 = 16$$

$$q = 4$$

Then we find that price needs to be

$$p = 2(4) = 8$$

b. Since each firm's individual supply is equal to their marginal cost as long as it is larger than AVC we can derive the individual firms supply curve by finding the MC

$$q_s = MC = \frac{\delta TC}{\delta q} = 4q$$

If the inverse quantity supplied is:

$$p = 4q$$

Then,

$$q = \frac{1}{4}p$$

We then multiply by 400 on both sides to find the total supply which is:

$$Q = q * 400 = \frac{400}{4}P$$

$$Q_s = 100p$$

c. In a competitive market in the long run number of firms isn't fixed, the market supply curve is fixed at the minimum of AC. Therefor we can find the market quantity by differentiating AC with respect to q and set it equal to 0:

$$AC = q^2 - 16q + 109$$

$$\frac{\delta AC}{\delta q} = 2q - 16 = 0$$

$$q = 8$$

Since AC is equal to equilibrium price we set AC equal to p and insert q=8 to find the price:

$$p = (8)^2 - 16(8) + 109$$

$$p = 64 - 128 + 109 = 45$$

The long run equilibrium price is thereby 45.

d. Since each firm will supply a quantity of 8, and the total demanded quantity is:

$$Q_D = 2050 - 10(45) = 1600$$

We then simply divide 1600 by 8 and find that there is:

$$\frac{1600}{8} = 200\ firms$$

e. Babette's Baguettes (BB) doesn't earn a positive profit in the long run, because her average costs are equal to the price. If she raises the price in a competitive market she will sell 0 baguettes. She shouldn't exit the market, because 0 economic profit is the maximum she can earn in the long run.