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1. a) Let the Marginal Utility of ham be MU_h and that of cheese be MU_c.

Quantity	MU_h	MU_c
1	15	12
2	11	9
3	9	6
4	6	5
5	4	3
6	3	2
7	1	1

In addition to it, let the price of ham be P_h and that of cheese P_c.

I	Quantity	MU_h	MU_c	$\frac{MU_h}{P_h}$	$\frac{MU_c}{P_c}$	choice	Remaining budget
	1	15	12	15	12	ham 1	6
	2	11	9	11	9	cheese 1	5
\$7	3	9	6	9	6	ham 2	4
	4	6	5	6	5	cheese 2	3
	5	4	3			ham 3	2
	6	3	2			cheese 3	1
	7	1	1			ham 4	0

To maximize her utility, we need to get to the state of $\frac{MU_h}{P_h} = \frac{MU_c}{P_c}$ which means that the net benefits of ham and cheese are the same.
So, to find that state, we will find it as follows. First, we find the MU for each ham and cheese (MU_h and MU_c). Then, divide each MU_h and MU_c by each cost P_h and P_c to get the net benefit. Finally, we compare the net benefits of the two and choose the higher one. By repeating this method, we can find the number of units where the net benefits of ham and cheese are equal, which is the number that maximizes her utility.

$\therefore \begin{cases} \text{Ham} : 4 \\ \text{Cheese} : 3 \end{cases}$ #

1.b) It is because $\frac{MU_h}{P_h} = \frac{MU_c}{P_c}$ is not established. For example, in condition where her budget is more than \$7, the equation is not established. Also, if the net benefits change due to the change of MU or price, it does not hold, neither.
Therefore, even if I apply 4 hams and 3 cheeses into a condition, if it is in a condition where $\frac{MU_h}{P_h} = \frac{MU_c}{P_c}$ does not hold, her utility will not be maximized.

2.a) $|MRS_{xy}(B)| = \left|\frac{\Delta y}{\Delta x}\right| = \frac{9-18}{4-2} = \left|\frac{-9}{2}\right| = \frac{9}{2} = \frac{MU_x}{MU_y}$

Since point B is the cosumer's equilibrium, $\frac{MU_x}{MU_y} = \frac{P_x}{P_y}$ is established.

$$\frac{MU_x}{MU_y} = \frac{P_x}{P_y}$$

$$\frac{9}{2} = \frac{P_x}{10}$$

$$P_x = 45 \qquad \therefore P_x = 45 \ \#$$

2.b) From 1.a), $\frac{P_x}{P_y}$ on point B is $\frac{9}{2}$.

$$\frac{P_x}{P_y} = \frac{9}{2}$$

$$\frac{180}{P_y} = \frac{9}{2}$$

$$P_y = 40$$

Then, when we find the budget line on point B which is the same as the tangent line on that point,

$$BL: \text{Budget} = P_x \cdot X + P_y \cdot Y$$
$$= 180 \cdot 4 + 40 \cdot 9$$
$$= 720 + 360$$
$$= 1080 \qquad \therefore \text{Budget} = 1080 \ \#$$

2.c) C: (4, 18)) MU_x is not changed. MU_y is lost since the TU decreases. $U(IC_2) > U(IC_1)$

B: (4, 9)) MU_x is gained since the TU increases. $U(IC_2) > U(IC_1)$ MU_y is not changed.

D: (8, 9)

average of MU_x $\frac{(4-4)+(8-4)}{2} = 2$ $\therefore MU_x = 2$ #

2.d) When we consider it, we compare different points on the same ICs. Looking at the IC_1,

$U(\text{point } A) = U(\text{point } B)$

$U(2, 18) = U(4, 9)$

On the point A, the MU_y is low and MU_x is high because a consumer consumes lots of nuts and not so many of avocado. However, the reason why the utility on the point B is still the same as A is that the more a consumer consumes avocado the lower the MU_x becomes, and the less a consumer does nuts, the higher the MU_y becomes. We can see this from the point C and D on IC_2 as well. Therefore, we can say this consumer's utility received from consuming avocado is in accordance with the law of diminishing MU since we know the more a consumer does avocado, the lower the MU_x becomes.