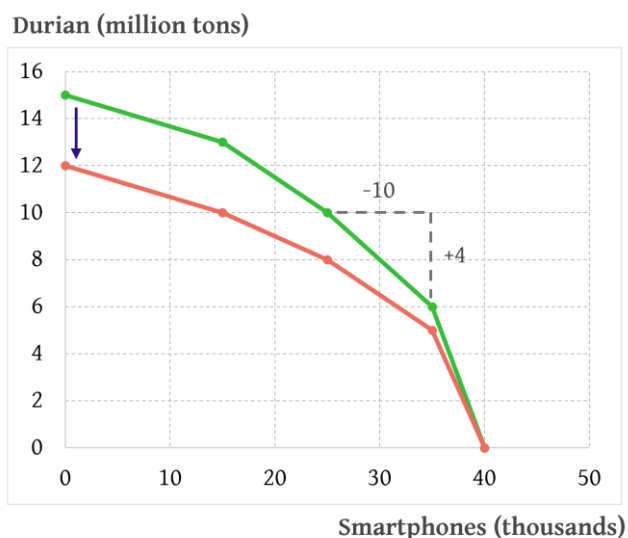


NOTE: This key is to provide mainly answers and rough explanation. Your explanation in the exam should be elaborated.

1. [Total 25 points] Suppose an economy can produce two products. When all resources are used efficiently, the combinations of outputs are given in the table below.

Durian (Million tons/Year)	Smartphones (1000 units)
0	40
6	35
10	25
13	15
15	0

a) [10 points] Draw the production possibility curve to illustrate the resource allocation between the production of these two goods, where the x-axis represents the amount of durians and y-axis represents the number of smartphones. Explain why the curve is downward sloping and why it is concave to the origin (i.e. bow-shaped).



[Green curve] The downward sloping curve is concave to the origin due to the increasing opportunity cost. (Note: the reason behind this has not been discussed in class yet. Increasing opportunity is sufficient to get full mark)

b) [5 points] Suppose the economy is currently producing 35,000 units of smartphones and 6 million tons of durians, calculate the opportunity cost of producing additional 4 million tons of durians. What is the opportunity cost of 1 million ton of durians?

[Gray dotted lines] In order to produce 4 million tons of durian, the trade-off of **10 thousand smartphones** must be made. This is the opportunity cost for 4 million tons of durian. An average per million tons of durian is then $10 / 4 = 2.5$ thousand smartphones.

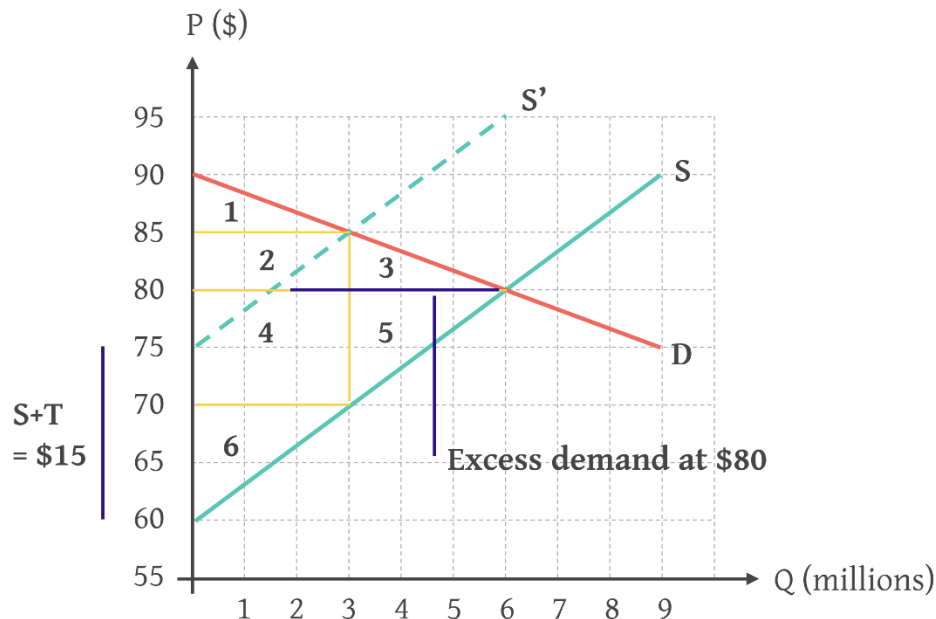
c) [5 points] From part (b), if a neighbor economy offers to give 3,000 smartphones in exchange for 1 million tons of durian, should this offer be taken? Why?

Sure. According to (b), 2.5 thousand smartphones are to be given up producing domestically. The offer is more than reasonable to be taken.

d) [5 points] Suppose that there is a flood affecting the production of durians. How would the curve drawn in part a. change? Assume that everything else remain constant.

[Red curve] When there is flood, durian production encounters a setback. Therefore, total of possible durians that can be produced drops. (The numbers on the red curve are hypothetical.)

2. [Total 45 points] Assumed that a labor market of 3D work (dirty, dangerous, demeaning) is perfectly competitive with abundant of demand and supply, millions of people supply their labor and firms demand for labor on different levels of price displayed in a graph below. Answer the following questions and provide economic reason(s).



a) [5 points] Figure out equilibrium price and quantity in this market.

$P_e = \$80$, $Q_e = 6$ millions.

b) [10 points] Calculate price elasticity of demand and price elasticity of supply **at the equilibrium**.

Calculate point elasticity of demand and supply at the equilibrium, using intercepts on P-axis as reference points.

$$\bullet \epsilon_d = \frac{Q_2 - Q_1}{P_2 - P_1} \cdot \frac{P_1}{Q_1} = \frac{0 - 6}{90 - 80} \cdot \frac{80}{6} = -8$$
$$\bullet \epsilon_s = \frac{Q_2 - Q_1}{P_2 - P_1} \cdot \frac{P_1}{Q_1} = \frac{0 - 6}{60 - 80} \cdot \frac{80}{6} = 4$$

When price rises by 1 percent, quantity demanded drops by 8 percent while quantity supplied increases by 4 percent.

c) [5 points] If the government imposes unit tax on sellers of \$15 will there be excess demand or supply **at the original equilibrium price**? Explain how the excess can be balanced according to price mechanism.

When unit tax is implemented, supply will eventually shift upward for \$15 and will end up at S'. However, at \$80, there is excess demand. Therefore, price needs to go up at \$85 to balance the quantity demanded and quantity supplied.

d) [10 points] According to the unit tax in (c), illustrate the changes in consumer surplus and producer surplus before and after tax implementation.

Before tax : CS = 1+2+3 ; PS = 4+5+6

After tax : CS = 1 ; PS = 6

e) [10 points] According to the unit tax in (c), explain and indicate the tax burden borne by buyers and sellers. Who bears more burden and why?

Area number 2 and 4 are tax burden on buyers and sellers. Tax burden for the sellers is higher due to less elasticity, calculated in 2.2.

f) [5 points] Calculate the **value** of deadweight loss stemmed from the unit tax.

Deadweight loss due to income tax is area 3+5. Calculate the area of this triangle, we get

$$\frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 15 \times 3 = \$22.5 \text{ million.}$$

3. [Total 30 points] A consumer chooses two substitutes, burgers and chips. A table of total utility received from consuming each unit of the product is given below. Answer the following questions.

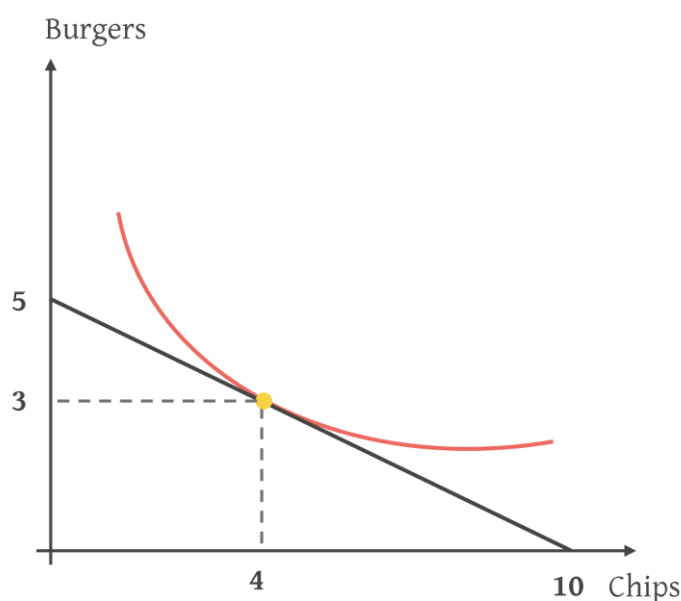
Unit	Total utility from burgers	MU (burgers)	MU/P (burgers)	Total utility from chips	MU (chips)	MU/P (chips)
1	12	12	6	9	9	9
2	22	10	5	17	8	8
3	30	8	4	23	6	6
4	36	6	3	27	4	4
5	40	4	2	29	2	2

a) [10 points] If this consumer has \$10, a burger costs \$2 and a pack of chips costs \$1, how many burgers and packs of chips this consumer chooses to have utility maximized. Show your work.

Two conditions must be satisfied: First, marginal utility of burgers over price must be equal to marginal utility of chips over price. Second, the budget must be all spent.

The only consumption bundle (number of burgers and chips) that satisfies the conditions is this consumer chooses 3 burgers and 4 packs of chips. The expenditure will be exactly $(\$2 \times 3) + (\$1 \times 4) = \$10$

b) [10 points] Roughly draw an indifference curve and a budget line to illustrate this consumer's equilibrium, given that vertical axis represents number of burger while horizontal axis represents number of packs of chips. Also, indicate the intercepts of the budget line and the optimum consumption bundle on the graph to get full mark.



The red curve is an indifferent curve while the dark blue line is the budget line of this consumer. The intercept on the vertical axis and horizontal axis at 5 and 10 respectively, resulting from taking all budget to buy burgers or chips (10/2 and 10/1). Lastly, the optimal consumption bundle is on (4,3) as displayed on the graph from, taken from **(a)**.

c) [10 points] How much is the marginal rate of substitution (MRS) measured at this consumer's equilibrium. Show the calculation or base your answer on any property.

The necessary condition of consumer's equilibrium is $\frac{MU_x}{MU_y} = \frac{P_x}{P_y}$.

Therefore, the first way to answer this question is to imply that at the equilibrium the slope of budget line must be equal to the slope of indifferent curve. The slope of this budget line is $\frac{1}{2}$, hence the MRS, the slope of indifferent curve, must also be $\frac{1}{2}$.

The second way to answer this question is to figure $\frac{MU_x}{MU_y}$ from the table. At the equilibrium, the marginal utility of burger is 8 while the marginal utility of chips is 4. From the definition of $MRS_{xy} = \frac{\Delta y}{\Delta x} = \frac{MU_x}{MU_y}$, then $\frac{MU_x}{MU_y} = \frac{8}{4} = \frac{1}{2}$.