University of Oum El-Bouaghi

Faculty of Economics Commercial and Management Sciences

First Year

Microeconomics 1

First series of exercises

First Exercise:

We have the total utility (TU) schedule from consuming various quantities of commodity X per unit of time:

Qx	1	2	3	4	5	6	7	8	9
TUx	40	80	110	130	145	155	160	160	158

1-Find the marginal utility, 2- plot the total and marginal utility curves.3- find the saturation point

Second Exercise:

The table below illustrates the marginal utility data for an individual for two goods, assuming their prices are both 1 and his income is 11:

Q	1	2	3	4	5	6	7	8
TUx	11	10	9	8	7	6	5	4
TUy	19	17	15	13	12	10	8	6

1-State the consumer's equilibrium condition mathematically.

2-Determine how the individual should allocate his income between the two goods to maximize his utility.

3-What is the level of satisfaction the individual obtains at the equilibrium point?

Third Exercise:

A consumer with individual preferences consumes two goods, X and Y, and you have the total utility (TU) schedule from consuming various quantities of commodity X and Y per unit of time:

Q	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
TUx	**180**	**310**	**400**	**460**	**505**	**535**	**555**	**570**
TUy	**80**	**142**	**190**	**226**	**252**	**270**	**282**	**292**

1. Complete the table if the price of X is Px=5 and the price of Y is Py=2, and the income is M=37.

2. Determine the consumption bundle that maximizes the consumer's utility.

3. Calculate the total utility the consumer receives at equilibrium."

Fourth Exercise:

Let the consumer's utility function be represented as **TU = XY.**

1-What do X and Y represent?

2-Calculate the marginal utilities. Are they increasing, decreasing, or constant?

3-Calculate the level of satisfaction for the consumer at the combination (X = 2, Y = 3).

Fifth Exercise:

Consider the consumer utility function can be written as $TU = X^{1/2} Y^{1/2}$.

Assume Px=3, Py=1, M=120

find the equilibrium quantities that maximize his satisfaction.

What represents the Lagrange multiplier?

Sixth Exercise:

Suppose the consumer's utility function can be represented by $TU=X^{3/4} Y^{1/4}$

Determine the demand functions that maximize the utility function.

Assume Px=2, Py=2, M=20 Find the equilibrium point.

Seventh Exercise:

If the consumer's utility function is $TU=X^{1/2} Y$

and the quantities that achieve maximum satisfaction are X = Y = 4, calculate the prices of the goods when (M = 24).

Eighth Exercise:

If the utility function is **TU = 1/2 XY**

and the price of good X is 1 and the price of good Y is 2,

1-Determine the demand functions that lead to a reduced expenditure at a utility level of 25.5.
2-Calculate the required income for that.

Solution of the First series of exercises:

Exersice1:

X	1	2	3	4	5	6	7	8	9
TUX	40	80	110	130	145	155	160	160	158
MUx	40	40	30	20	15	10	5	0	-2

The Total and Marginal utility curves

Plot the curves here.

Saturation point: The point where the total utility received by an individual from consuming a commodity is maximum and the marginal utility is zero it occurs when the consumer has 8 units of X

Exersice2 :

X	1	2	3	4	5	6	7	8
MU_X	11	10	9	8	7	6	5	4
MU_Y	19	17	15	13	12	10	8	6
MU_X/px	11	10	9	8	7	6	5	4
MU_{Y}/Py	19	17	15	13	12	10	8	6

The quantity of good X that achieves equilibrium for this consumer:

$$\lambda = 10 \longrightarrow X=2,\ Y=6 \longrightarrow 2*1+6*1=8 \neq M$$

$$\lambda = 8 \longrightarrow X=4,\ Y=7 \longrightarrow 4*1+6*1=11 = M$$

$$\lambda = 6 \longrightarrow X=6,\ Y=8 \longrightarrow 6*1+8*1=14 \neq M$$

the point of the equilibrium is

$$Y=7 \quad X=4$$

The total utility is : TU=TUx+TUy=(11+10+9+8)+(19+17+15+13+12+10+8)=132

Exercise3:

The mathematical consumer's equilibrium condition is: **MUx/Px = MUy/Py**

Q	1	2	3	4	5	6	7	8
TUx	180	310	400	460	505	535	555	570
TUy	80	142	190	226	252	270	282	292
MUx	180	130	90	60	45	30	20	15
MUy	80	62	48	36	26	18	12	10
MUx/Px	36	26	18	12	9	6	4	3
MUy/Py	40	31	24	18	13	9	6	5

The quantity of good X that achieves equilibrium for this consumer:

$$\lambda = 18 \quad \rightarrow \quad X=3,\ Y=4 \ \rightarrow \quad 3*5+4*2=23 \neq M$$

$$\lambda = 9 \quad \rightarrow \quad X=5,\ Y=6 \ \rightarrow \quad 5*5+6*2=37 = M$$

$$\lambda = 6 \quad \rightarrow \quad X=6,\ Y=7 \ \rightarrow \quad 6*5+7*2=44 \neq M$$

the point of the equilibrium is

$$Y=6 \quad X=5$$

The total utility is: $TU = TUx + TUy = 505+270=775$

Exercise4:

Let the consumer's utility function be represented as **TU = XY.**

1- X and Y represent the goods that the consumer chooses to consume.

2-Calculate the marginal utilities.

$MUx = dU/dX = Y$

$MUy = dU/dY = X$

Are they increasing, decreasing, or constant.

$dMUx/dx = d^2U/dX^2 = 0$

$dMUy/dy = d^2U/dY^2 = 0$

the marginal utilities are constant

3-Calculate the level of satisfaction for the consumer at the combination (X = 2, Y = 3).

$U = XY = 2*3 = 6$

Exercise5:

We start by forming the Lagrangian function as follows:

$L = X^{1/2} Y^{1/2} + \lambda(120 - 3X - Y)$

Assume Px=3, Py=1, M=120

Taking partial derivatives:

$L'x = 1/2X^{-1/2}Y^{1/2} - \lambda\ 3 = 0$ ...(1)

$L'y = 1/2X^{1/2}Y^{-1/2} - \lambda = 0$ ...(2)

$L'\lambda = 120 - 3X - Y = 0$ ...(3)

By dividing equation (1) by equation (2), we obtain:

$Y/X = 3/1 \Rightarrow Y = 3X$ …....(4)

Substituting equation (4) into equation (3), we find:

$120 – 3X – 3X = 0$

$120=6X$

$X^*=20$ ……...(5)

Substituting equation (5) into equation (4), we get:

$Y^* = 60$

we obtain the following equilibrium quantities:

$X^* = 20$ and $Y^* = 60$

As for the Lagrange multiplier, it represents the marginal utility of money, which is the utility of an additional monetary unit. It varies from person to person, as the marginal utility of Algerian dinars for a rich person differs from its marginal utility for a poor person.

Exercise6:

Consider the consumer’s utility function $TU=X^{3/4}Y^{1/4}$

We start by forming the Lagrangian function as follows:

$L = X^{3/4}Y^{1/4} + \lambda(M - XPx - YPy)$

Taking partial derivatives:

$L'x = 3/4X^{-1/4}Y^{1/4} - \lambda Px = 0$ ...(1)

$L'y = 1/4X^{3/4}Y^{-3/4} - \lambda Py = 0$ ...(2)

$L'\lambda = M - XPx - YPy = 0$ ...(3)

By dividing equation (1) by equation (2), we obtain:

$3Y/X = Px/Py \Rightarrow Y = (Px/3Py)\ X$ …....(4)

Substituting equation (4) into equation (3), we find:

$M - XPx - (Px/3Py)\ X * Py = 0$

$M=4/3XPx$

$X^* = 3M/4Px$ ……...(5)

Substituting equation (5) into equation (4), we get:

$Y^* = M/4Py$

By substituting the values of income and prices, we obtain the following equilibrium quantities:

$X^* = 15$ and $Y^* = 2.5$

Exercise7:

First, we have to find the equilibrium demand functions:

$L = \mathbf{X^{1/2} Y} + \lambda(M - XPx - YPy)$

Taking partial derivatives:

$L'x = 1/2X^{-1/2}Y - \lambda Px = 0$ ...(1)

$L'y = X^{1/2} - \lambda Py = 0$ ...(2)

$L'\lambda = M - XPx - YPy = 0$ ...(3)

By dividing equation (1) by equation (2), we obtain:

$Y/2X = Px/Py \Rightarrow Y = (Px/Py)\ 2X$ …....(4)

Substituting equation (4) into equation (3), we find:

$M - XPx - (Px/Py)\ 2X * Py = 0$

$M = 3XPx$

$X^* = M/3Px$ ……...(5)

Substituting equation (5) into equation (4), we get:

$Y^* = 2M/3Py$

If X = Y = 4, calculate the prices of the goods when (M = 24).

$X^* = 4 = 24/3Px \Rightarrow Px = 2$

$Y^* = 4 = 2*24/3Py \Rightarrow Py = 4$

Exercise8:

If the utility function is TU = **1/2 XY**

and the price of good X is 1 and the price of good Y is 2, determine the demand functions that lead to a reduced expenditure at a utility level of TU= 25.5. Calculate the required income for that.

First, we have to find the equilibrium demand functions:

$L = XPx + YPy + \lambda(U_0 - 1/2\mathbf{XY})$

Taking partial derivatives:

$L'x = Px - \lambda\ 1/2Y- = 0$ ...(1)

$L'y = Py – \lambda 1/2\ X= 0$ ...(2)

$L'\lambda = U_0 - 1/2\mathbf{XY} = 0$ ...(3)

By dividing equation (1) by equation (2), we obtain:

$Px/Py = Y/X \Rightarrow Y= (Px/Py)\ X$ …....(4)

Substituting equation (4) into equation (3), we find:

$U_0 - 1/2\mathbf{X}(Px/Py)\ X = 0$

$U_0 =1/2\ (Px/Py)\ X^2$

$X^*=(2\ U_0\ Py/Px)^{1/2}$ ……...(5)

Substituting equation (5) into equation (4), we get:

$Y^* = (2\ U_0\ Px/Py)^{1/2}$

If Px=1 Py=2 and TU=25.5, calculate the equilibrium quantities

$X^*=(2\ U_0\ Py/Px)^{1/2}=10$

$Y^* = (2\ U_0\ Px/Py)^{1/2}=5$

M=XPx+YPy=10*1+5*2=20