Department of Computer Science and Engineering

Introduction to Economics

Individual Assignment I

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1. Why you have to learn this course (Use examples and logic to explain its importance for you)

Learning Economics is important because it helps me understand how the world works in terms of money, resources, production, and decision-making. Whether I become an engineer, entrepreneur, policymaker, or even a household manager, economics affects my daily life and future decisions.

For example:

- If I plan to start a tech company, I need to understand how demand and supply affect pricing, how to allocate limited resources efficiently, and how to make smart investment decisions.
- As a citizen, economics helps me understand how government policies (like taxes, subsidies, and interest rates) impact my living standards.
- Even at a personal level, when I choose between spending or saving, or buying one item over another, I'm applying economic thinking.

learning economics equips me with logical tools to solve problems, analyze trade-offs, and make informed decisions in both personal and professional life.

2. Discuss scarcity, shortage, and choice

- **Scarcity** is the fundamental economic problem of having limited resources to satisfy unlimited wants and needs. It affects everyone — individuals, businesses, and governments. For instance, time, money, raw materials, and skilled labor are all scarce. Because of scarcity, we can't have everything we want, so we must make choices.
- **Shortage** occurs when the demand for a product is higher than its supply at a given price. Unlike scarcity (which is permanent), a shortage is temporary. For example, a fuel shortage can occur due to a supply chain disruption, but it's usually resolved over time.
- **Choice** arises because of scarcity. Since we can't have everything, we are forced to make choices about how to use our resources. Every choice involves a trade-off, meaning we must give up something to gain something else. For example, if I spend time studying economics, I give up the time I could spend watching a movie.

3. Explain the production possibility curve (PPC)

The Production Possibility Curve (PPC) is a graph that shows the maximum combination of two goods or services that an economy can produce using all its resources efficiently.

- The PPC illustrates the concept of opportunity cost — to produce more of one good, we must produce less of another.
- Any point on the curve shows efficient use of resources.
- Any point inside the curve shows underutilization or inefficiency.
- Any point outside the curve is unattainable with current resources and technology.

The PPC helps economies decide what mix of goods to produce and shows how resources must be shifted when priorities change.

4. Assume that a certain simplified economy produces only two goods, X and Y, with given resources and technology. The following table gives the various possible combinations of the production of the two goods (all units are measured in millions of tons).

a) Calculate the opportunity cost of the production of good X at each point. What law does the trend in those values exhibit?

Production Possibility	Good X	Good Y	Opportunity Cost of Good X
A	0	100	-
B	2	90	5
C	4	60	15
D	6	20	20

Trend: Opportunity cost increases as production of Good X increases.

-This demonstrates the **Law of Increasing Opportunity Cost** — as more of one good is produced, more and more of the other good must be sacrificed.

b) What changes are required for this economy to shift the PPF outward?

To shift the **Production Possibility Frontier (PPF) outward**, the economy must **increase its productive capacity**. This can be done through:

1. **Technological advancement** – improving technology to produce more with the same resources.
2. **Increase in resources** – such as more labor, capital, or natural resources.
3. **Improved education and training** – which increases labor productivity.

4. **Investment in infrastructure** – better transportation, energy, and communication systems.
5. **Trade and specialization** – engaging in international trade can allow access to more goods and better resource allocation.

5. Suppose the individual demand function of a product is given by: Q=20 – 2P and there are about 100 identical buyers in the market. Then the calculate the market demand function

Ans: Market demand function (Q^M) = Q_i × number of buyers

QM=100×(20–2P)

Q^M = 2000 - 200P

➔ **Market Demand Function: Q = 2000 - 200P**

6. Show graphically the shift in the demand curve due to the change in some factors affecting it (show it at least for 3 main factors)

Demand Curve Shifts: Three Main Factors

1. Income of Consumers

- **Normal Goods**: When income increases, demand increases → curve shifts **right**.
- **Inferior Goods**: When income increases, demand decreases → curve shifts **left**.

2. Consumer Preferences / Tastes

- If a good becomes more popular (e.g., trend or health benefits), demand increases → curve shifts **right**.
- If it becomes less desirable (e.g., health warning), demand decreases → curve shifts **left**.

3. Price of Related Goods

- **Substitute Goods**: If the price of a substitute rises, demand for this good increases → shift **right**.
- **Complementary Goods**: If the price of a complement rises, demand decreases → shift **left**.

7. Explain price, income, and cross elasticities for both demand and supply

Price Elasticity of Demand (PED):

Measures how much the **quantity demanded** of a good responds to a change in **its own price**.

$$PED = \%\ change\ in\ price\ /\ \%\ change\ in\ quantity\ demanded$$

- **If PED > 1 → Elastic**
- **If PED < 1 → Inelastic**
- **If PED = 1 → Unitary**

Price Elasticity of Supply (PES):
Measures how much the **quantity supplied** responds to a change in **price.**

$$PES = \frac{\%\ change\ in\ price}{\%\ change\ in\ quantity\ supplied}$$

Income Elasticity of Demand (YED):
Measures how quantity demanded changes with **income** changes.

$$YED = \frac{\%\ change\ in\ income}{\%\ change\ in\ quantity\ demanded}$$

- **YED > 0 → Normal good**
- **YED < 0 → Inferior good**
- **YED > 1 → Luxury good**

Cross Price Elasticity of Demand (XED):
Measures how demand for one good responds to the **price change of another good.**

$$XED = \frac{\%\ change\ in\ price\ of\ Good\ B}{\%\ change\ in\ quantity\ demanded\ of\ Good\ A}$$

- **XED > 0 → Substitutes**
- **XED < 0 → Complements**

8. What are factors affecting supply?

Factors affecting supply include:

1. **Price of the good** – higher price generally increases supply.
2. **Cost of production** – lower input costs increase supply.
3. **Technology** – better tech increases productivity and supply.
4. **Number of sellers** – more sellers increase supply.
5. **Government policies** – taxes or subsidies affect supply.
6. **Expectations of future prices** – if prices are expected to rise, producers may reduce current supply.

7. **Natural factors –** weather, disasters, etc. affect agricultural and natural resource-based supply.

9. Based on the following table which indicates expenditure of the household on a commodity, answer the questions that follow (The price of the good is Br.10)

Income (Br / month)	**Quantity Demanded (units / month)**
10,000	**50**
20,000	**60**
30,000	**70**
40,000	**80**
50,000	**90**

A) Calculate income elasticity of demand
Using the formula:

$$YED = \frac{\%\ change\ in\ Income}{\%\ change\ in\ QD}$$

From 10,000 to 20,000:

$$\%\Delta Q = \frac{60-50}{50} = 0.2 = 20\%$$

$$\%\Delta I = \frac{20{,}000-10{,}000}{10{,}000} = 1.0 = 100\%$$

$$YED = \frac{12.5\%}{25\%} = 0.5$$

From 40,000 to 50,000:

$$\%\Delta Q = \frac{90-80}{80} = 0.125 = 12.5\%$$

$$\%\Delta I = \frac{50{,}000-40{,}000}{40{,}000} = 0.25 = 25\%$$

$$YED = \frac{12.5\%}{25\%} = 0.5$$

B) Is this a normal, inferior, or luxury good? Justify.

Since **YED > 0**, it is a **normal good.**
But since **YED < 1**, it is **not a luxury good.**

It is a **necessity-type normal good** — demand increases with income, but slowly.

C) Does the proportion of household income spent on this good increase or decrease as income increases? Why?

- **Total spending** on the good = Quantity × Price = e.g., 50 × 10 = Br. 500
- At Br. 10,000 income, 500 is **5%** of income
- At Br. 50,000 income, spending is 900 → only **1.8%** of income

As income increases, **the proportion spent decreases.**

This is because the good is a **necessity** — people don't increase consumption proportionally with income.

10. Tea price rises from Br. 10 to 15; coffee demand rises from 3000 to 5000 cups

A) Determine cross-price elasticity

$\%\Delta Qd = \frac{5000-3000}{3000} = 0.667 = 66.7\%$

$\%\Delta Ptea = \frac{15-10}{10} = 0.5 = 50\%$

$XED = \frac{66.7\%}{50\%} = 1.33$

⇒**Cross-Price Elasticity = 1.33**

B) What kind of relation exists between the two goods?

Since **XED > 0**, tea and coffee are **substitute goods.**

A rise in the price of tea increases the demand for coffee.

11. Discuss the approaches to measuring utility and the indifference curve

A) Utility Measurement Approaches:

1. **Cardinal Utility Approach:**
    - Utility can be **measured numerically.**
    - Example: Consuming 1 apple = 10 utils, 2 apples = 18 utils.
    - Based on **marginal utility.**
    - Law of Diminishing Marginal Utility applies.
2. **Ordinal Utility Approach:**
    - Utility **can't be measured**, but can be **ranked.**

- Example: I prefer coffee to tea, but I don't assign numbers.
- Basis of **indifference curve analysis**.

B) Indifference Curve:

- A graph showing **combinations of two goods** that give a consumer **equal satisfaction**.
- **Downward sloping**: More of one good means less of the other.
- **Convex to the origin**: Reflects **diminishing marginal rate of substitution**.
- **Higher curve = higher utility**.
- Cannot intersect.

12. A firm's production function is described by the equation Q = 10, 000L – 3L 2 , where L stands for labor units.

a. Calculate the output maximizing labor level.

$$Q = 10,000L - 3L^2$$

$$\frac{dQ}{dL} = 10,000 - 6L$$

$$10,000 - 6L = 0$$

$$L = 10,000\,6 \approx 1,666.67$$

The output-maximizing labor level is approximately 1,666.67 labor.

b. What is the maximum output?

Substitute L = 1, 666.67:

$$Q = 10,000 \times 1,666.67 - 3 \times (1,666.67)^2$$

$$(1,666.67)^2 \approx 2,777,777.78$$

$$Q = 16,666,700 - 3 \times 2,777,777.78 \approx 8,333,366.66$$

The maximum output is approximately 8,333,366.66 units.

13. Given a utility function and if the consumer has birr 100 to spend on two goods X and Y with prices birr 3 and birr 5 respectively. Then derive:

a. The equation of the budget line and sketch the graph.

The budget constraint is: 3X + 5Y = 100 Solve for Y : Y = 100 – 3X 5 = 20 – 0.6X

Budget line equation: 3X + 5Y = 100 or Y = 20 – 0.6X.

Graph description: The budget line is a straight line with intercepts at X = 100 3 ≈ 33.33 (when Y = 0) and Y = 20 (when X = 0). The slope is – 3/5 = –0.6.

b. Utility maximizing combinations of X and Y and use the indifference curve to show the max. point.

Generally, utility is maximized where the budget line is tangent to an indifference curve, i.e., where the marginal rate of substitution (MRS) equals the price ratio:

MRSX,Y = PX PY = 3/5 = 0.6

Solve simultaneously with the budget constraint 3X +5Y = 100. Without a utility function, specific values for X and Y cannot be determined.

Indifference curve description: The indifference curve is convex and tangent to the budget line at the optimal point. Answer: The utility-maximizing combination occurs where MRS = 0.6 and 3X + 5Y = 100. Provide the utility function for a precise solution.

c. Calculate the marginal rate of substitution of X for Y (MRSX,Y) at equilibrium and interpret your result.

At equilibrium, the MRS equals the price ratio: MRSX,Y = PX PY = 3 5 = 0.6

Interpretation: The consumer is willing to give up 0.6 units of Y for one unit of X, matching the market trade-off. This ensures utility maximization within the budget.

Answer: MRSX,Y = 0.6, indicating a trade-off of 0.6 units of Y for 1 unit of X.

14. Suppose the short-run production function of a certain cut-flower firm is given by: $Q = 4KL - 0.6K^2 - 0.1L^2$**, where Q is the quantity of cut-flower produced, L is labor input, and K is fixed capital input (K = 5). Substitute K = 5:**

$$Q = 4 \times 5 \times L - 0.6 \times 5^2 - 0.1L^2 = 20L - 15 - 0.1L^2$$

$$Q = -0.1L^2 + 20L - 15$$

a. Determine the average product of labor (APL) function.

$$APL = Q\,L = -0.1L^2 + 20L - 15\,L = -0.1L + 20 - 15\,L$$

$$The\ APL\ function\ is\ AP\,L = -0.1L + 20 - 15\,/L\,.$$

b. At what level of labor does the total output of cut-flower reach the maximum? Maximize Q = –0.1L^2 + 20L – 15:

dQ/dL = –0.2L + 20

–0.2L + 20 = 0 L = 100

Second derivative: d2Q/dL2 = –0.2 Since it's negative, L = 100 is a maximum.

Answer: Total output is maximized at 100 labor units.

c. What will be the maximum achievable amount of cut-flower production?
Substitute L = 100: Q = −0.1 × 1002 + 20 × 100 − 15 = −1, 000 + 2, 000 − 15 = 985
Answer: The maximum output is 985 units of cut-flowers.

15. Explain the relationship between short-run production and cost functions.
In the short run, at least one input (e.g., capital) is fixed, while others (e.g., labor) are variable. The **production function** shows how inputs produce output, and the **cost function** translates this into costs.

- **Production Stages**:
  - **Increasing returns**: Adding variable input (e.g., labor) significantly increases output.
  - **Diminishing returns**: Additional input increases output at a decreasing rate.
  - **Negative returns**: Output decreases with more input.
- **Cost Functions**:
  - **Total Fixed Cost (TFC)**: Constant, as fixed inputs don't change.
  - **Total Variable Cost (TVC)**: Increases with output, tied to variable input use.
  - **Total Cost (TC)**: TC=TFC + TVC.
- **Relationship**:
  - High marginal product (MP) in the increasing returns stage lowers marginal cost (MC).
  - Diminishing returns increase MC as additional output requires more input.
  - Average product (AP) peaks when average variable cost (AVC) is minimized.
  - The production function's shape drives the cost curves via variable input costs.

The short-run production function's stages shape cost functions. High MP reduces MC and AVC, while diminishing returns increase them, linking productivity to costs.

16. Explain and summarize each market structure.

1. **Perfect Competition**:

    - **Characteristics**: Many firms, identical products, easy entry/exit, firms are price takers.
    - **Summary**: Firms produce where price equals marginal cost (P = MC), earning zero economic profit in the long run. Example: Agricultural markets (e.g., wheat).
    - **Key Features**: No market power, high competition, efficient.
2. **Monopoly**:
    - **Characteristics**: Single firm, unique product, high barriers to entry, price maker.
    - **Summary**: Monopolists set price above MC, producing less and charging more than in perfect competition. Example: Utilities (e.g., electric companies).
    - **Key Features**: High market power, potential inefficiency.
3. **Monopolistic Competition**:
    - **Characteristics**: Many firms, differentiated products, easy entry/exit, some price control.
    - **Summary**: Firms differentiate products, set price above MC, but entry leads to zero long-run profit. Example: Restaurants.
    - **Key Features**: Product variety, some market power.
4. **Oligopoly**:
    - **Characteristics**: Few firms, identical or differentiated products, high barriers, interdependent decisions.
    - **Summary**: Firms may collude or compete, with pricing based on strategy. Example: Airlines.
    - **Key Features**: Interdependence, potential for high profits.

- **Perfect Competition**: Many firms, identical products, price takers, zero long-run profit.
- **Monopoly**: Single firm, unique product, price maker, high profits.
- **Monopolistic Competition**: Many firms, differentiated products, some price control, zero long-run profit.
- **Oligopoly**: Few firms, interdependent, high barriers, strategic pricing.