NANYANG TECHNOLOGICAL UNIVERSITY
SCHOOL OF SOCIAL SCIENCES
SEMESTER 1 AY25-26

HE1002 MACROECONOMICS I

PROBLEM SET 1

1-1

Suppose a gold miner finds a gold nugget and sells the nugget to a mining company for $500. The mining company melts down the gold, purifies it, and sells it to a jewelry maker for $1,000. The jewelry maker fashions the gold into a necklace that it sells to a department store for $1,500. Finally, the department store sells the necklace to a customer for $2,000. How much has GDP increased as a result of these transactions?

1-2

Table 7P-1 shows the price of inputs and the price of outputs at each step in the production process of making a shirt. Assume that each of these steps takes place within the country.

Table 7P-1

	Cotton farmer ($)	Fabric maker ($)	Sewing and printing ($)
Inputs	0	1.10	3.50
Value of output	1.10	3.50	18.00

a. What is the total contribution of this shirt to GDP, using the standard expenditure method?

b. If we use a value-added method (i.e., summing the value added by producers at each step of the production process, equal to the value of outputs minus the price of inputs), what is the contribution of this shirt to GDP?

c. If we mistakenly added the price of both intermediate and final outputs without adjusting for value added, what would we find that this shirt contributes to GDP? By how much does this overestimate the true contribution?

1-3

The U.S. government gives income support to many families living in poverty. How does each of the following aspects of this policy contribute to GDP?

a. Does this government's expenditure on income support count as part of GDP? If so, in which category of expenditure does it fall?

b. When the families buy groceries with the money they've received, does this expenditure count as part of GDP? If so, in which category does it fall?

c. If the families buy new houses with the money they've received, does this count as part of GDP? If so, in which category does it fall?

1-4

Given the following information about each economy, either calculate the missing variable or determine that it cannot be calculated.

a. If C = $20.1 billion, I = $3.5 billion, G = $5.2 billion, and NX = -$1 billion, what is total income?

b. If total income is $1 trillion, G = $0.3 trillion, and C = $0.5 trillion, what is I?

c. If total expenditure is $675 billion, C = $433 billion, I = 105 billion, and G = $75 billion, what is NX? How much are exports? How much are imports?

1-5

Using Table 7P-2, calculate the following.

Table 7P-2

Sector	Value (millions)
Consumption	$770,000
Investment	$165,000
Government spending	$220,000
Net exports	– $ 55,000
Population	50

a. Total gross domestic product and GDP per person.

b. Consumption, investment, government purchases, and net exports, each as a percentage of total GDP.

c. Consumption, investment, government purchases, and net exports per person.

1-6

Determine which category each of the following economic activities falls under: consumption (C), investment (I), government purchases (G), net exports (NX), or not included in GDP.

a. The mayor of Chicago authorizes the construction of a new stadium using public funds.
b. A student pays rent on her apartment.
c. Parents pay college tuition for their son.
d. Someone buys a new Hyundai car produced in South Korea.
e. Someone buys a used Hyundai car.
f. Someone buys a new General Motors car produced in the United States.
g. A family buys a house in a newly-constructed housing development.
h. The U.S. Army pays its soldiers.
i. A Brazilian driver buys a Ford car produced in the United States.
j. The Department of Motor Vehicles buys a new machine for printing drivers' licenses.
k. An apple picked in Washington in October is bought at a grocery store in Mississippi in December.
l. Hewlett-Packard produces a computer and sends it to a warehouse in another state for sale next year.

1-7

Table 7P-3 shows economic activity for a very tiny country. Using the expenditure approach determine the following.

Table 7P-3

Activity	Total value (thousands of $)
Families buy groceries	600
Electronics company sells HD projectors to households	100
Personal trainer gives Zumba class	5
Custard stand sells pistachio ice cream	2
Police department buys new cars	500
Mayor leads creation of new education budget	300
Elevator construction company builds new factory	600
Local businessperson purchases corn from Mexico	400
Sports-gear company sells hockey gloves to Canadian team	200
Bike store sells used carbon-fiber bikes	200
Local stockbroker executes trades for clients	2,000

a. Consumption.
b. Investment.
c. Government purchases.
d. Net exports.
e. GDP.

1-8

During the 2008 recession sparked by financial crisis, the U.S. economy suffered tremendously. Suppose that, due to the recession, the U.S. GDP dropped from $14 trillion to $12.5 trillion. This decline in GDP was due to a drop in consumption of $1 trillion and a drop in investment of $500 billion. The U.S. government, under the current president, responded to this recession by increasing government purchases.

a. Suppose that government spending had no impact on consumption, investment, or net exports. If the current presidential administration wanted to bring GDP back up to $14 trillion, how much would government spending have to rise?

b. Many economists believe that an increase in government spending doesn't just directly increase GDP, but that it also leads to an increase in consumption. If government spending rises by $1 trillion, how much would consumption have to rise in order to bring GDP back to $14 trillion?

1-9

Assume Table 7P-4 summarizes the income of Paraguay.

Table 7P-4

Category	Value (billions of $)
Wages	8.3
Interest	0.7
Total business expenditures	21.0
Total business revenues	30.0

a. Calculate profits.

b. Calculate the GDP of Paraguay using the income approach.

c. What would GDP be if you were to use the value-added approach?

d. What would GDP be if you were to use the expenditure approach?

1-10

Table 7P-5 provides information about the cost of inputs and the value of output for the production of a road bike. Note there are four different stages of production.

Table 7P-5

Raw materials	Manufacturing	Construction	Sale by the retailer
• Rubber for one tire ($20) • Aluminum for the frame ($80) • Other component materials ($70)	• Tire maker sells tires for $30 each • Frame maker sells bike frame and components for a total of $250	• Bike mechanic puts everything together and sells the bike for $350	• Retailer sells the bike for $500

a. What value is added by the supplier of the raw materials?
b. What value is added by the tire maker?
c. What value is added by the maker of the frame and components?
d. What value is added by the bike mechanic?
e. What value is added by the bike store?
f. What is the total contribution of the bike to GDP?

1-11

Imagine that the United States produces only three goods: apples, bananas, and carrots. The quantities produced and the prices of the three goods are listed in Table 7P-6.

a. Calculate the GDP of the United States in this three-goods version of its economy.

b. Suppose that a drought hits the state of Washington. This drought causes the quantity of apples produced to fall to 2. Assuming that all prices remain constant, calculate the new U.S. GDP.

c. Assume, once again, that the quantities produced and the prices of the three goods are as listed in Table 7P-6. Now, given this situation, carrot sellers decide that the price of carrots is too low, so they agree to raise the price. What must be the new price of carrots if the U.S. GDP is $60?

Table 7P-6

Goods	Quantities produced	Prices ($)
Apples	5	2.00
Bananas	10	1.00
Carrots	20	1.50

1-12

Suppose that the British economy produces two goods: laptops and books. The quantity produced and the prices of these items for 2023 and 2024 are shown in Table 7P-7.

Table 7P-7

Year	Quantities produced	Price ($)
2023	Laptops = 50 Books = 1,000	Laptops = 200 Books = ?
2024	Laptops = 100 Books = ?	Laptops = $150 Books = 10

a. Let's assume that the base year was 2023 so that real GDP in 2023 equals nominal GDP in 2023. If the real GDP in Britain was $15,000 in 2023, what was the price of books?

b. Using your answer from part a, if the growth rate in nominal GDP was 10 percent, how many books must have been produced in 2024?

c. Using your answers from parts a and b, what is the real GDP in 2022? What was the growth rate in real GDP between 2023 and 2024?

1-13

Based on Table 7P-8, calculate nominal GDP, real GDP, the GDP deflator, and the inflation rate in each year, and fill in the missing parts of the table. Use 2022 as the base year.

Table 7P-8

Year	Quantity of oranges	Price of orange ($)	Quantity of beach balls	Price of beach ball ($)	Nominal GDP ($)	Real GDP ($)	GDP deflator	Inflation rate (%)
2022	500	1.00	850	5.00				
2023	600	1.50	900	7.50				
2024	750	1.65	1,000	8.25				

1-14

Based on Table 7P-9, calculate nominal GDP per capita in 2021 and 2022, and the real GDP growth rate between the two years. Which countries look like they experienced recession in 2021-2022?

Table 7P-9

	2021			2022		
Country	Nominal GDP (billions of $)	Real GDP (billions of $)	Population	Nominal GDP (billions of $)	Real GDP (billions of $)	Population
Artemis	554.10	458.25	44,044,811	625.92	446.731	44,494,502
Gaia	332.48	271.710	96,442,593	253.25	286.149	98,423,595
Hermes	3,479.23	3,883.870	82,657,002	4,211.64	3,939.23	82,927,922
Pan	42.78	50.620	29,121,471		53.79	29,767,108
Zeus	18,624.95	17,348.63	325,147,121	20,412.87	17,844.28	327,167,434

1-15

Table 7P-10 describes the real GDP and population of a fictional country in 2023 and 2024.

Table 7P-10

Year	Real GDP (billions of $)	Population (millions)
2023	10	1.0
2024	12	1.1

a. What is the real GDP per capita in 2023 and 2024?

b. What is the growth rate in real GDP?

c. What is the growth rate in population?

d. What is the growth rate in real GDP per capita?

1-16

Table 7P-11 shows data on population and expenditures in five countries, as well as the value of home production, the underground economy, and environmental externalities in each.

a. Calculate GDP and GDP per capita in each country.

b. Calculate the size of home production, the underground economy, and environmental externalities in each country as a percentage of GDP.

c. Calculate total and per capita "GDP-plus" in each country by including the value of home production, the underground economy, and environmental externalities.

d. Rank countries by total and per capita GDP, and again by total and per capita "GDP-plus." Compare the two lists. Are the biggest and the smallest economies the same or different?

Table 7P-11

Country	C ($)	I ($)	G ($)	Net exports ($)
Bohemia	9,800,000,000	230,000,000	950,000,000	−120,000,000
Silesia	450,000,000	78,000,000	100,000,000	13,000,000
Bavaria	2,125,000,000	319,000,000	597,000,000	134,000,000
Saxony	2,750,000,000	75,000,000	1,320,000,000	−45,000,000
Ottoman Empire	6,225,000,000	567,000,000	1,435,000,000	1,000,000

Country	Population	Home production ($)	Underground economy ($)	Environmental externalities ($)
Bohemia	1,200,000	1,250,000,000	5,770,000,000	−1,560,000,000
Silesia	160,000	75,000,000	128,000,000	−45,000,000
Bavaria	425,000	386,000,000	1,450,000,000	−523,000,000
Saxony	760,000	146,000,000	250,000,000	−820,000,000
Ottoman Empire	800,000	432,000,000	654,000,000	−396,300,000

1-17

Suppose a parent was earning $20,000 per year working at a local firm. The parent then decides to quit his job in order to care for his child, who was being watched by a babysitter for $10,000 per year. Does GDP rise, fall, or stay constant with this action, and how much does GDP change (if at all)?