MEASUREMENT IN MACROECONOMICS

1. Gross output is 15 860.5; productive consumption is 4 120.2; depreciation is 720.1; income of foreigners earned inside the country 612.2; income of domestic actors earned abroad 502.6; indirect tax: 601.2; company profit: 802.3; social security contribution: 702.3; net interest payment: 382.1; dividends: 202.3; transfers to private persons: 620.2; personal income tax (PIT) 902.3.

Calculate the known indicators of the SNA system!

2. We know the following data on a small economy (billion $): its gross national product is 80, while its net national product is 66. Domestic entrepreneurs earned 6 profits abroad, while foreign investors earned 5 profits in the country. Domestic employees earned 4 abroad, while foreigners earned 3 inside the country.

Determine the GDP and the net national disposable income!

3. Consumption is 2100, gross investment is 600, 10% of investment is supplementary investment. Government purchases equal net investment and the trade balance shows 55 deficit. Domestic entrepreneurs and employees transferred 120 home, while foreign entrepreneurs and employees earned 85 in the country. Indirect tax is 10 percent of GDP.

Determine GNP and NI!

4. There are only two types of goods in an economy, bread and cars. The table shows data from two years: Choose 1990 for base year and calculate nominal and real GDP for both of the years, then GDP deflator and CPI!

	Year 1990	**Year 2000**
Price of cars ($)	**50 000**	**60 000**
Price of bread ($)	**10**	**20**
Number of cars	**100**	**120**
Number of bread	**500 000**	**400 000**
Nominal GDP		
Real GDP		

5. In our economy we have domestically produced and consumed and imported goods. The following table shows data for two periods of time:

Year	**Qx** domestic	**Px** domestic	**Qy** domestic	**Py** domestic	**Qz** imported	**Pz** imported	*Nominal GDP*	*Real GDP*
2002	**100**	**5**	**30**	**8**	**70**	**12**		
2003	**120**	**7**	**45**	**10**	**80**	**15**		

Choose 2002 for base and calculate nominal and real GDP for both years, then GDP deflator and CPI!

6. Calculate economic growth, nominal and real GDP (based on 2007's prices), GDP deflator and CPI!

Year	**Qx** exported	**Px** exported	**Qy** domestic	**Py** domestic	**Qz** imported	**Pz** imported	*Nominal GDP*	*Real GDP*
2007 (0)	**180**	**6**	**30**	**12**	**70**	**16**		
2008 (1)	**150**	**8**	**45**	**15**	**60**	**19**		

7. Let's suppose only milk and bread is consumed in our country. In the base year of 2002 a representative consumer ate 20 kg of bread and drank 150 liters of milk. The price of bread was 100 Ft/kg, while the price of milk used to be 150 Ft/liter. In 2003, the bread's price became 120 Ft/kg, while the price of milk was 180 Ft/liter, and the amounts consumed: 30 kg and 170 liters.

a. Calculate CPI for the year 2003!
b. Calculate the GDP deflator!

8. In a country people consume 2 goods, strawberries and chocolate. We know the information provided in the table below. Price of chocolate increased by 40% in one year. Calculate the missing data.

	Year 2010 (0)	**Year 2011 (1)**
Price of strawberries (1kg)	30	32
Price of chocolate (1kg)	10	
Quantity of strawberries (kg)		
Quantity of chocolate (kg)	2000	2020
Nominal GDP		69880
Real GDP	50000	
GDP deflator		
CPI		

SOLUTIONS

1.
GDP=11740.3; NDP=11020.2; GNP=11630.7; NNP=10910.6; NI=10309.4; Personal Income=10265.3; Personal Disposable Income=9363.

2.
GDP=78 bn$; Personal Disposable Income=66 bn$

3.
GDP=3185; NI=2841.5

4.

	Year 1990	**Year 2000**
Nominal GDP	*10 000 000*	*15 200 000*
Real GDP	*10 000 000*	*10 000 000*

GDP deflator=1.52
CPI=1.6

5.

Year	*Nominal GDP*	*Real GDP*
2002	*740*	*740*
2003	*1290*	*960*

GDP deflator=1.344; CPI=1.2975

6.

Year	*Nominal GDP*	*Real GDP*
2007	*1440*	*1440*
2008	*1875*	*1440*

GDP deflator=1.302; CPI=1.2027

7.

Year	**2002**	**2003**
Quantity of bread	**20**	**30**
Quantity of milk	**150**	**170**
Price of bread	**100**	**120**
Price of milk	**150**	**180**
Nominal GDP	*24500*	*34200*
Real GDP	*24500*	*28500*

GDP deflator=1.2
CPI=1.2

8.

	Year 2010 (0)	**Year 2011 (1)**
Price of strawberries (1kg)	**30**	**32**
Price of chocolate (1kg)	**10**	*14*
Quantity of strawberries (kg)	*1000*	*1300*
Quantity of chocolate (kg)	**2000**	**2020**
Nominal GDP	*50000*	**69880**
Real GDP	**50000**	*59200*
GDP deflator	*1*	*1,1804*
CPI	*1*	*1,2*

CIRCULAR FLOW OF INCOME

TRUE OR FALSE STATEMENTS

1. The income of the households can be determined as the sum of their consumption, tax and savings.

2. If government purchase equals the value of tax paid by the private sector, the government has a balanced budget.

3. The macroeconomic income equals to the wages received by the households.

4. If the economy is in a long-run equilibrium, national savings equals the macroeconomic income less the consumption and government purchase.

5. In the long-run if savings decrease assuming a constant disposable income, investment will increase causing a decrease in the interest rate.

1. In a three-player macroeconomic model, we know the size of the following income flows as expressed in a given unit of measurement: total income 5040, consumption 3200, wages paid 3600, investments 640, corporate savings 340, state savings 160, corporate tax 1100, household 560.
a. Enter the items above into the current items accounts of income flow.
b. Calculate the size of government purchases, household savings and household transfer.

2. In a three-player macroeconomic model, we know the size of the following income flows as expressed in a given unit of measurement: consumption 6000, government purchase 1850, savings of households 700, savings of companies 500, tax paid by companies 1200, transfer to households 420 and to companies 100, investment is 1050.
Determine tax paid by households, wages, savings of the government and the macroeconomic income.

3. In a three-player macroeconomic model, we know the size of the following income flows as expressed in a given unit of measurement: GDP is 9000, companies pay 5900 as wages to households, transfer to households is 1640 and to companies is 200, tax paid by households is 960, consumption is 6400, companies pay 2200 as tax, deficit of the government budget is 300.
Determine government purchase, investment, savings of the private sector.

4. Consumption in an economy is 800 while households receive 850 as wages. Transfer given to households is 200, to companies is 50. Companies pay 300 as taxes, while households pay the half. Investment is 300. Government buys products and services for 250. Determine GDP, saving of the sectors.

5. In a three-player macroeconomic model, we know the size of the following income flows as expressed in a given unit of measurement, grouped according to the sectors:

Households	**Companies**	**Government**
C = 4600	S_C = 5000	
S_H = 500	T_C = 1900	S_G = 500
T_H = 1400	Y = 12600	
	TR_C = 300	

Enter the items above into the current items accounts of income flow. Determine the missing data (W; TR_H ; G;I) .

6. We know the following information about a closed economy: consumption is 15.000, government purchase 5.600, investment 7.000. Tax paid by the firms 4.800, by households 4.000. Companies received 400 as transfer, while that of the households was 5.000. Households received 17.000 from the companies. Determine the macroeconomic income, and the savings of the economic actors!

7. The budget of a country has a 60 deficit. The companies save 10% of the wages paid. The final output is 750. Private sector transfer is 100. The savings of the private sector is 150. Savings of the households is just the double of the transfers they receive. The wage (income) of the households is 600, while they pay 100 as a tax. Determine the missing data.

8. Determine the income equations of the open economy if we know the following data: the budget shows a 100 deficit, the income of the government is 900, the private sector gets no transfers. The tax of the households is half of the companies'. The export is twice as much as the import, while the savings of the foreign actors shows 250 deficit. The depreciation is 300, that is 1/8 of the GDP. The net investment is half of the gross investment. The wages are 100% more than the consumption is.

SOLUTIONS

1. G=1200, S_H=140, TR_H=300, TR_C=0
2. T_H=1020, W=7300, S_G=-150, Y=8900
3. G=1620, I=980, S_C=1100, S_H=180
4. Y=1350, S_H=100, S_C=250, S_G=-50
5. W=6000, TR_H=500, G=2000, I=6000
6. Y=27600, S_C=6200, S_H=3000, S_G=-2200
7. C=455, S_H=90, TR_H=45, T_G=145, S_G=60, TR_G=55, G=205, I=90
8. TR_H=0, TR_G=0, T_H=300, T_G=600, Y=2400, I=600, X=500, IM=250, G=1000, C=550, W=1100, S_V=700, S_H=250

ECONOMIC GROWTH
Solow Growth Model I.
(excluding population growth and technological progress)

TRUE OR FALSE STATEMENTS

1. If the capital per worker is less in the economy than in the Golden Rule Steady State, then ceteris paribus the saving rate will increase.

2. The Solow model assumes a Cobb-Douglas production function with an increasing returns to scale. (növekvő mérethozadék)

3. In the Solow model the slope of the production function shows how much the output increases if the labour increases by one unit.

4. If the economy starts with more capital per worker than in the steady state, the investment increases more than the depreciation of the capital.

5. The government preserving a constant high level of saving rate can ensure a stable long run growth in the economy.

EXERCISES

I/1. The Aggregate Production function of an economy is: $Y = K^{1/2} L^{1/2}$. Consumption rate is 85%. Capital goods on average can be used for 30 years. The rate of both population growth and technological progress are zero. Calculate the amount of capital stock per worker, output per worker and consumption per worker if k=12. Is k=12 a steady state amount of per capita capital stock? If not, calculate it.

I/2.The production function per capita is $y = k^{0,5}$. Each year 5% of capital is worn out. We exclude both population growth and technological progress. The economy is in steady state if the capital per worker is 30. Determine the rate of consumption.

I/3. The Aggregate Production function of an economy is: $Y = K^{1/4}L^{3/4}$. Consumption rate is 60%, capital can be used for 18 years on average. We exclude both population growth and technological progress. Calculate the amount of per-worker capital stock, per-worker output and consumption per worker in the steady state!

I/4. Fill in the table bellow and set the steady state amount of capital per worker.
The saving rate is 20%, capital goods can be used on an average of 25 years, the per-worker production function is: $y= k^{0,5}$.

Capital per capita k	Output per capita **y**= $k^{0,5}$	Consumption per capita **c**	Investment per capita i	Depreciation per capita δk	Change in the amount of capital per capita Δk
0					
4					
12					
16					
25					
36					

I/5. We know the following about the economy. The production function is $Y=K^{2/3}*L^{1/3}$. Fill in the table and determine the steady state level of capital accumulation.

k	y	i	c	Depreciation	Δk= sy-δk
0					
16		**1,59**			
100				**4**	
121					
196					
244					
256					

I/6. The Aggregate Production function of an economy is: $Y = K^{1/2}L^{1/2}$. Capital stock can be used for 30 years on average, while both population growth and technological progress are 0. According to the golden rule determine the amount of capital per worker, the maximum of consumption and the saving rate needed to reach this state.

I/7. The table below contains possible steady state amounts of capital per worker in an economy. Let's suppose capital goods depreciate over 20 years on average. Fill in the table and set the amount of capital per worker according to the golden rule of consumption! Production function is: $y= k^{0,5}$

Capital per capita **k***	Output per worker **y***=f(k*)= $(k^*)^{0,5}$	Depreciation per worker (δk)	Consumption per capita **c*=y***-δk*	Saving per worker sy*=s$(k^*)^{0,5}$
0				
4				
16				
36				
64				
100				
121				
144				

I/8. The table below contains possible steady state amounts of capital per worker in an economy. Let's suppose capital goods depreciate over 15 years on average. Fill in the table and set the amount of capital per worker according to the golden rule of consumption!

Capital per capita k^*	Output per worker $y^*= (k^*)^{0,6}$	Depreciation per worker δk^*	Consumption per capita $c^*=y^*-\delta k^*$	Saving rate s^*
0				
10				
50				
100				
200				
400				
700				

SOLUTIONS

I/1. *$y=3,46$ $c=2,94$ $i=0,52$ $\delta k=0,4$*

$sy\neq\delta k$ $0,52\neq0,4$ It is not a steady state.

$k^*=20,25$

I/2. *$1-s= 0,73$*

I/3. *$k^*=13,90$ $y^*=1,93$ $c^*=1,16$*

I/4. *$\delta=0,04$ $s=0,2$*

The amount of capital per worker where $\Delta k=0$ is $k^*=25$

Capital per capita k	*Output per capita* $y= k^{0,5}$	*Consumption per capita* c	*Investment per capita* i	*Depreciation per capita* δk	*Change in the amount of capital per capita* Δk
0	*0*	*0*	*0*	*0*	*0*
4	*2*	*1,6*	*0,4*	*0,16*	*0,24*
12	*3,46*	*2,77*	*0,69*	*0,48*	*0,212*
16	*4*	*3,2*	*0,8*	*0,64*	*0,16*
25	*5*	*4*	*1*	*1*	*0*
36	*6*	*4,8*	*1,2*	*1,44*	*-0,24*

I/5. *$y=k^{2/3}$ $\delta= 4/100= 0,04$ $s= 1,59/16(2/3)=0,25$ $k^*=244$*

k	**y**	**i**	**c**	**Depreciation**	**$\Delta k= sy-\delta k$**
0	0	0	0	0	0
16	6,35	1,59	4,75	0,64	0,945
100	21,54	5,39	16,15	4	1,385
121	24,46	6,12	18,34	4,84	1,275
196	33,74	8,44	25,30	7,84	0,595
244	39,04	9,76	29,28	9,76	0
256	40,32	10,08	30,24	10,24	-0,16

I/6. $k^*_{gold}=225$ $c^*_{max}=7,5$ $s^*_{gold}=0,5$

I/7. *δ=1/20=0,05* *k^*_{gold}=100*

Capital per capita **k***	Output per worker **y***=f(k*)= $(k^*)^{0,5}$	Depreciation per worker (δk*)	Consumption per capita **c*=y***-δk*	Saving per worker sy*=s$(k^*)^{0,5}$
0	*0*	*0*	*0*	*0*
4	*2*	*0,2*	*1,8*	*0,2*
16	*4*	*0,8*	*3,2*	*0,8*
36	*6*	*1,8*	*4,2*	*1,8*
64	*8*	*3,2*	*4,8*	*3,2*
100	***10***	***5***	***5***	***5***
121	*11*	*6,05*	*4,95*	*6,05*
144	*12*	*7,2*	*4,8*	*7,2*

I/8. *δ=1/15=0,067* *k^*_{gold}=200*

Capital per capita k*	Output per worker y*= $(k^*)^{0,6}$	Depreciation per worker δk*	Consumption per capita c*=y*-δk*	Saving rate s*
0	0	0	0	---
10	3,98	0,67	3,31	0,17
50	10,45	3,33	7,12	0,32
100	15,84	6,67	9,17	0,42
200	24,02	13,33	10,69	0,55
400	36,41	26,64	9,77	0,73
700	50,93	46,67	4,26	0,92

ECONOMIC GROWTH
Solow Growth Model II.
(including population growth and technological progress)

II/1. In an economy the per capita production function is the following: $y= k^{3/4}$. The population spends 80% of its income on consumption. The rate of depreciation is 10%, the rate of population growth is 1,5% and the rate of technological progress is 2,5%.
Calculate the amount of per-worker capital stock, per-worker output and consumption per worker in the steady state!

II/2. Production function per capita in an economy is: $y = k^{0,4}$. Marginal rate of consumption is: 80%, the rate of depreciation is 10%, the rate of population growth is 1,5% while the rate of technological progress is 2,5%.
Calculate the steady state amount of capital per worker, output per worker and consumption per worker!

II/3. Egy gazdaságban az egy főre jutó kibocsátási függvény: y = k3/4 . A fogyasztási ráta 78%, az amortizációs ráta 3%, a népesség növekedési üteme 1,5% és a technológia fejlődési üteme 2,5%. Számolja ki az egy főre jutó tőkeállomány, kibocsátás és fogyasztás nagyságát stacionárius helyzetben!

II/4. The production function per worker of an economy is $y = k^{0,6}$. The rate of saving is 15% while 4% of the stock of capital wears out each year on average. Population growth is 1% and technological progress is 2%. Calculate the amount of per-worker capital stock, per-worker output and consumption per worker in the steady state!

II/5. The table below contains possible steady state amounts of capital per worker in an economy. Let's suppose capital goods depreciate over 20 years on average. The rate of population growth is 2%, technological progress is 3%. Fill in the table and set the amount of capital per worker according to the golden rule of consumption if the aggregate production function is $Y = K^{3/5}(EL)^{2/5}$

Capital per worker k*	
0	
5	
15	
40	
80	
200	
250	
300	

II/6. The table below contains possible steady state amounts of capital per worker in an economy. Depreciation rate is 4,5%. The rate of population growth is 1,8%, technological progress is 2,2%. Fill in the table and set the amount of capital per worker according to the golden rule of consumption if the production function per worker is $y = k^{0,65}$!

Capital per worker k*	
0	
10	
20	
50	
100	
300	
500	
1000	

II/7. The Aggregate Production function of an economy is: $Y = K^{2/3}(EL)^{1/3}$. Capital stock can be used for 17 years on average, while population growth is 2% and technological progress is 3%. According to the golden rule determine the amount of capital per worker, the maximum of consumption and the saving rate needed to reach this state.

II/8. The capital stock in an economy is about 3 times one year's GDP. Depreciation of capital is about 15% of the GDP. Capital's share in output is about 40%. Real GDP grows an average of 3% per year (growth rate (n+g)).

Determine how many percentage of capital depreciates each year. Determine marginal product of capital and the net marginal product of capital. What can we conclude according to the data given in the exercise?

II/9. We assume that the production function per worker is $2*\sqrt[3]{k}$. Population of the country was 8 million last year, in this year is 8,5 million people. The rate of technological progress is 2,5%, capital goods on average can be used for 25 years. The saving rate is 15%.

a) Determine the output in the steady state in the function of the saving, the population growth , the technological progress and the depreciation.
b) Determine the steady state value of the output.
c) What amount of capital is needed to reach the Golden Rule level of capital accumulation? What should the government do to reach it?

SOLUTIONS

II/1 $k^*=4,18$ $y^*=2,92$ $c^*=2,34$
II/2. $k^*=1,81$ $y^*=1,27$ $c^*=1,02$
II/3. $k^*=97,21$ $y^*=30,96$ $c^*=24,15$
II/4. $k^*=6,70$ $y^*=3,13$ $c^*=2,66$

II/5. $y=k^{3/5}$ $\delta=1/20= 0,05$ $\delta+n+g=0,1$

k^*	$y^*=k^{*3/5}$	$i^*=(\delta+n+g)k^*$	$c^*=y^*-i^*$
0	0	0	0
5	2,63	0,5	2,13
15	5,08	1,5	3,58
40	9,15	4	5,15
80	13,86	8	5,86
200	24,02	20	4,02
250	27,46	25	2,46
300	30,64	30	0,64

$k^*_{gold}=80$

II/6. $\delta+n+g=0,085$

k^*	$y^*=k^{*0,65}$	$i^*=(\delta+n+g)k^*$	$c^*=y^*-i^*$
0	0	0	0
10	4,47	0,85	3,62
20	7,01	1,70	5,31
50	12,72	4,25	8,47
100	19,95	8,50	11,45
300	40,75	25,50	15,25
500	56,80	42,50	14,30
1000	89,13	85,00	4,13

$k^*_{gold}=300$

II/7. $k^*_{gold}=230,91$ $c^*_{max}=12,47$ $s^*_{gold}=0,67$

II/8. MPK=0,133 Net MPK=0,083 As Net MPK > growth rate in the economy, we have a capital level less than in the Golden Rule Steady State. The government should increase the saving rate and thus the investment.

II/9.

a) $y=\frac{(\delta+n+g)*k}{s}$ b) $3,61=k^*$; $y^*=3,06$ c) $k^*=12$ *The government should increase the saving rate. It will decrease immediately the consumption and increase the investment, but later on as y increases it causes an increase in consumption. The economy will reach a consumption level higher than the previous* → c^*_{max} *will be reached*

UNEMPLOYMENT

TRUE OR FALSE STATEMENTS

1. If 8% of employed individuals lose their job and 12% of the unemployed found a new job in a given period, it means that the natural rate of unemployment is 4%.

2. The natural rate of unemployment can be decreased by actions that increase the rate of job finding.

3. The main reason for having frictional unemployment is the real wage higher than the equilibrium.

4. Unemployment insurance has no effect on frictional unemployment.

5. In case of a real wage higher than the equilibrium only voluntary unemployment can occur, as the number of employed workers is determined by the demand for labour.

EXERCISES

1. In an economy the number of actives is 2000 thousand and it gives the 80% of those who are at the working age. The number of individuals who are not at the working age is 300 thousand, while there are 150 thousand unemployed people in the economy.

a) Determine the rate of unemployment.
b) Determine the number of employed individuals.
c) Determine the number f those who are at the working age.
d) Determine the population of the country.
e) Determine the economic activity rate.

2. In a country the number of actives is 10 million and that of the employees is 8 million. The only reason why unemployment occurs is that it takes time to match workers and jobs. We also know the rate of job separation: 0,01.

a) How large is the rate of job finding?

3. We know that the labour force in the country does not change and in the first month the natural rate of unemployment is the rate of unemployment in the economy. In this month the number of employees is 23 million and the number of unemployed is 2 million. We also know that the 23% of the unemployed find a job this month.

a) How large is the labour force? How large can the unemployment be in the first month? What percentage of the employees will become unemployed during the first month?
b) Let's suppose that the rate of finding a job will decrease to f'=0,2, while the rate of separation rises to s'=0,03 and won't change in the future. Fill in the gaps of the table below! Which direction is the unemployment going to change to?

	Month 1	Month 2	Month 3
Employees (E)			
Unemployed (U)			
Unemployment rate (U/L)			

c) How large the new steady state rate of unemployment is going to be?

4. In an economy the demand for labour is: N_D=5500-10(W/P), while the supply of labour is: N_S=5(W/P)-500, the number of actives is 2000.

a) Determine the equilibrium real wage. How many of the actives are employed? What type of unemployment occurs?
b) What are the changes in the labour market if the real wage becomes 450?
c) Characterize the labour market if the real wage is 380.

5. In an economy the number of actives is 8 million, of employees is 7 million. The only reason why unemployment occurs is that it takes time to match workers and jobs. We know that the rate of job finding is 0,1.

a) How large is the rate of job separation?
b) We know the following about the population: the 2/3 of the population belongs to this at the working age, 65% of the working age population is active. Determine the population of this economy and the rate of unemployment!
c) The demand curve of labour is N_D=6500-3(W/P), the supply curve of labour is N_S=6000+2(W/P). Determine the amount of compulsory unemployment, if the reason for the unemployment is not only the need of time to match the jobs and workers, and the real wage is 120% of the equilibrium wage.

6. In an economy the demand for labor is N_D=2000-2(W/P) while the supply of labor is N_S=1000+2(W/P). If the labour market is in equilibrium, the number of unemployed people will be 300.

a) How many people are employed and how high is the unemployment rate, if the current real wage is 120%-percent of the equilibrium real wage?
b) How large should the real wage be in order to reduce voluntary unemployment to zero?
c) Set another level of the real wage, by which the number of employees equals the value calculated in question "a"!

7. In an economy the active population is 14000 people. The demand and supply for labour are the following: N_D=15000-10W/P and N_S=25W/P-2500.

a) Determine the real wage and the number of employed individuals if there is equilibrium in the labour market.
b) We suppose that the new real wage is W/P_1=600. Determine the number of employed people and characterize the labour market.
c) Characterize the labour market if the real wage is W/P_2=300.
d) Determine that level of the real wage at which no voluntary unemployment occurs.

8. In an economy 3800 people are active. The demand and supply for labour are the following: N_D=4000-2W/P and N_S=5W/P-1250.

a) Determine the real wage and the number of the employed individuals in the state of equilibrium. What type of unemployment occurs? Determine the rate of unemployment.
b) Determine the real wage at which no compulsory unemployment occurs.
c) We assume that the new real wage is W/P_1=1000. Determine the number of employed people and characterize the labour market.
d) Characterize the labour market if the real wage is W/P_2=500.

SOLUTIONS

1. a) 7,5% b) 1850 c) 2500 d) 2800 e) 80%

2. f=4%

3. a) L=E+U=23+2=25 U/L=2/25=0,08→8%

"the natural rate of unemployment is the rate of unemployment in the economy"→ there is only frictional unemployment, so the labor market is in steady state→ U/L=s/(s+f) equation can be used, s=0,02

b)

	Month 1	Month 2	Month 3
Employees (E)	*23*	*22,71*	*22,48*
Unemployed (U)	*2*	*2,29*	*2,5133*
Unemployment rate (U/L)	*0,08*	*0,0916*	*0,1005*

f'=0,2;s'=0,03

Data of the 2nd month:

- $E_2=E_1+U_1f'-E_1s'$=23+2*0,2-23*0,03=22,71 (original number of employed people, we have to add those who find a job→ U_1f, but have to subtract the number of those former employees who lost their job. → E_1s)
- $U_2=U_1- U_1f'+E_1s'$=2-2*0,2+23*0,03=2,29 (employees and unemployed must be 25 together as we assume in the model, the number of labor force is fixed)
- U_2/L=2,29/22,71=0,0916

Data of the 3rd month:

- $E_3=E_2+U_2f'-E_2s'$=22,71+2,29*0,2-22,71*0,03=22,48
- $U_3=U_2- U_2f'+E_2s'$=2,29-2,29*0,2+22,71*0,03=2,5133
- U_3/L=2,5133/25=0,0916

c) steady state→U/L=s/(s+f), substitute s' and f' → U/L=0,03/(0,03+0,2)=0,13

4. a) $W/P^*=400$, $E^*=1500$, voluntary unemployment 25%
b) $E_1=1000$, $U_C=750$, $U_V=250$, $u_1=50\%$
c) $E_2=1400$, $U_V=300+300=600$, $u_2=30\%$

5. a) s=1,4%
b) Population=18,46 million people and és u=12,5%
c) $W/P^*=100$, $W/P_1=120$, $E_1=6140$, $U_C=100$

6. a) Aktívak=1800 fő, $W/P^*=250$, $W/P_1=300$, $E_1=1400$, $U_C=200$, $U_V=200$, u=22,22%
b) W/P=400
c) W/P=200

7. a) $W/P^*=500$, $E^*=10000$
b) $E_1=9000$, $U_C=3500$, $U_V=1500$, u=35,71%
c) $E_2=5000$, $U_V=9000$, u=64,29%
d) $W/P_3=660$

8. a) $W/P^*=750$, $E^*=2500$, $U_V=34,2\%$
b) there is no compulsory unemployment in the equilibrium or under the equilibrium wage (no voluntary unemployment if Ns is vertical→ Ns=actives → above W/P=1010)
c) $E_2=2000$, $U_C=1750$, $U_V=50$, u=47,4%
d) $E_3=1250$, $U_V=2550$, u=67,1%

MONEY AND INFLATION

TRUE OR FALSE STATEMENTS

1. If the rate of inflation is lower than the nominal interest rate, real interest rate must be positive.

2. If the expected inflation rate is higher (4%) than the real inflation rate (2%) is, the ex post real interest rate will be higher than the ex ante real interest rate (i=8%).

3. According to the classical dichotomy the nominal variables can be determined by the quantity of money.

4. The commercial banks can increase the quantity of money in the economy by open market operations, selling government bonds..

EXERCISES

1. The velocity of money in an economy is constant. The real GDP increases each year by 5% and the quantity of money increases 14% annually. The nominal interest rate is 11%. Determine the real interest rate.

2. In an economy we know the real GDP is 7550 million dollars and the GDP deflator is 1,127, while M=4210 million dollars. Determine the velocity of money if the price level in the base year was 1.

3. Fill in the following table:

Period of time	M	ΔM%	V	ΔV%	P	ΔP%	Y	ΔY%
1.	100	-	2	-	1	-	200	-
2.	104		2,02		1,03			

4. The following table shows the long-run growth of an economy:

Period of time	M	ΔM%	V	ΔV%	P	ΔP%	Y	ΔY%
1.	100	-	2	-	1	-	200	-
2.	103	3	2			0	206	
3.	97							
4.	107							

5. Fill in the following table:

Real interest rate (%)	Nominal interest rate (%)	Inflation rate (%)
	10	4
	10	8
	10	12
4	7	
-2	12	
3		5
-2		9

6. Fill in the following table:

ΔP%	ΔM%	Inflation rate (%)	Real interest rate (%)	Nominal interest rate (%)
0	3	0	3	3
	4		3	
	5		3	
	2		3	
	8		3	

SOLUTIONS

1. *π=9%; r=2%*

2. *V=2,021*

3.

Period of time	M	ΔM%	V	ΔV%	P	ΔP%	Y	ΔY%
1.	100	-	2	-	1	-	200	-
2.	104	**4%**	2,02	**1%**	1,03	**3%**	**204**	**2%**

4.

Period of time	M	ΔM%	V	ΔV%	P	ΔP%	Y	ΔY%
1.	100	-	2	-	1	-	200	-
2.	103	3	2	**0**	**1**	0	206	**3%**
3.	97	**-6%**	**2**	**0**	**0,9**	**-8%**	**212,18**	**3%**
4.	107	**10%**	**2**	**0**	**0,98**	**+7%**	**218,55**	**3%**

5.

Real interest rate (%)	Nominal interest rate (%)	Inflation rate (%)
6	10	4
2	10	8
-2	10	12
4	7	**3**
-2	12	**14**
3	**8**	5
-2	**7**	9

6.

ΔP%	ΔM%	Inflation rate (%)	Real interest rate (%)	Nominal interest rate (%)
0	3	0	3	3
1	4	**1**	3	**4**
2	5	**2**	3	**5**
-1	2	**-1**	3	**2**
5	8	**5**	3	**8**