1. **General macro concepts (20 points). Multiple choice: encircle correct answer.**

i. The following data are from an economy with 2 goods:

	2009	2010
Price good *X*	€ 10	€ 11
Price good *Y*	€ 41	€ 50
Quantity good *X*	90	100
Quantity good *Y*	100	90

How much higher is nominal GDP in 2010 than in 2009?

a) 0%
b) 12%
c) 25%
d) None of the above are correct.

ii. Consider an economy with 2 firms. Firm A produces 200 euro worth of output using labor and 100 euro of intermediate inputs. Firm B produces 100 euro of output using only labor, and sells the output to firm A.

a) Value added of the total economy is 200.
b) Value added of firm B is 0, because it uses no intermediate inputs.
c) Value added of firm A is 200.
d) Value added of the total economy is 300.

iii. A tourist from the US spends three nights in a hotel in Amsterdam. Which statement(s) is(are) true?

a) This increases GDP of the Netherlands and decrease net exports of the US.
b) This increases GDP of the Netherlands and increases consumption of the US.
c) This increases consumption of the US, but decreases net exports of the US
d) All of the above are correct.

iv. Assume that money supply increases 5%, GDP increases 1%, and the velocity of money increases 2%. What is the inflation rate?

a) 8%
b) 6%
c) 4%
d) -2%

v. What instrument can the Central Bank use to control the money supply?

a) The reserve ratio
b) The inflation rate
c) The currency-deposit ratio
d) None of the above

vi. Can actual expenditures differ from planned expenditures, and what would happen if planned expenditures are higher than actual expenditures?

a) No, actual and planned expenditures always are equal
b) Yes, we then enter a recession requiring fiscal stimulus
c) Yes, then the economy will have unplanned inventory accumulation.
d) None of the above

2. **A Classical economy (20 points).** An economy, without money, is described with the following accounting rules and behavioral equations:

Y = C + I + G + X - M, Y = 1000, G=500,
C(Y-T) = 100 + 2/3 (Y-T), T=400
I(r) = 300 – 25r, X=400, M=600

where: $Y =$ income/production; $G =$ government spending; $T =$ taxes; $C =$ consumption; $I =$ investment; $X =$ exports; $M = imports$; $r =$ domestic interest rate; [provide calculations, as well as numerical answers].

→ 5p for each part. 2 points subtracted for simple arithmetic errors, while approach is correct.

a. Compute private savings, public savings and national savings, and net capital inflow.

- $S_{private} = Y - T - C = Y - T - (100 + 2/3\,(Y - T)) = 1000 - 400 - 500 = \mathbf{100}$
- $S_{public} = T - G = 400 - 500 = \mathbf{-100}$
- $S_{national} = S_{private} + S_{public} = 100 + (-100) = \mathbf{0}$
- Capital inflow equals net exports. Hence, $|400 - 600| = \mathbf{200}$

b. What is the domestic interest rate in equilibrium?

$$Y = 100 + \frac{2}{3}(Y - T) + 300 - 25r + G + X - M$$

$$r = \frac{1}{25}\left[\left(100 + \frac{2}{3}(Y - T) + 300 + G + X - M\right) - Y\right]$$

$$r = \frac{1}{25}\left[\left(100 + \frac{2}{3}(1000 - 400) + 300 + 500 + 400 - 600\right) - 1000\right] = \frac{100}{25} = \mathbf{4}$$

c. If the interest rate does not change, compute what happens to income when autonomous investments falls such that investment demand is described by $\boldsymbol{I_{new}(r) = 200 - 25r}$. (Use the Keynesian multiplier.)

→ implicit use of multiplier is graded with full points.

$$Y = 100 + \frac{2}{3}(Y - T) + (200 - 25r) + G + X - M$$

$$\Delta Y = \frac{1}{1 - mpc} * -100 = \frac{1}{.333} * -100 = \mathbf{-300}$$

d. Given the change to investment in c. above, compute what happens to private and public savings.

→ answers without computation received max 2 points

Savings with new Y:

$S_{private} = Y - T - C = Y - T - (100 + 2/3\,(Y - T)) = 700 - 400 - 300 = \mathbf{0}$
$S_{public} = T - G = 400 - 500 = \mathbf{-100}$

Hence, private saving decreases with **100**, public savings **do not change**.

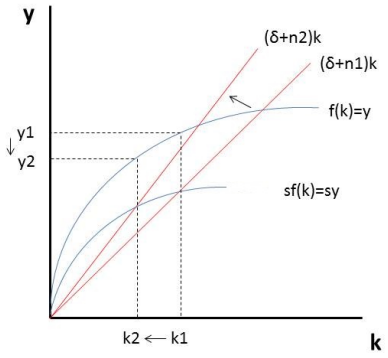
Question 3 (Solow model)

(a) Write down the equation determning the dynamics of the stock of capital per worker in the Solow model. Which flows are equal in the steady state?

- $\Delta k = sf(k) - \delta k$ (3 points)
- In steady state investment (or savings) equal depreciation: $sf(k) = \delta k$ (2 points)

(b) Show in the graph, and describe what happens to steady-state capital per worker and income per worker when the rate of population growth rises in the Solow model. (1 point for labelling axes, 2 points for drawing correct functions, 2 for correctly indicating the change)

Figure 1: Answer question 3b



- Due to higher population growth(n) there is less capital per worker (k) in equilibrium, which also lowers the income per worker (y).

(c) In the time series graphs, below, draw what happens to capital and output per capita (K/L and Y/L, respectively), when the savings rate is increased at time t. (5 points in total. 1 point subtracted for each 'error', which can be a jump, a wrong direction, a wrong long-term steady state)

(d) Assume that, initially, the marginal product of capital is smaller than the depreciation rate. Draw the time path of consumption per worker (C/L) when the savings rate is increased at time t. (5 points total. 2 points for drawing a jump, 1 for jump in the right direction, 2 for a correct long term steady state)

Figure 2: Question 2c: Capital per capita

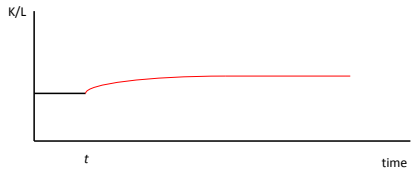


Figure 3: Question 2c: Output per capita

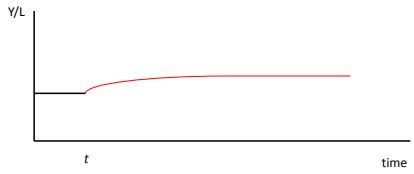
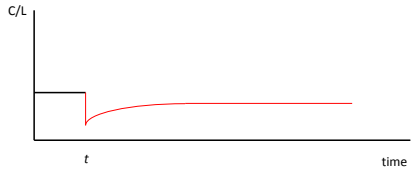


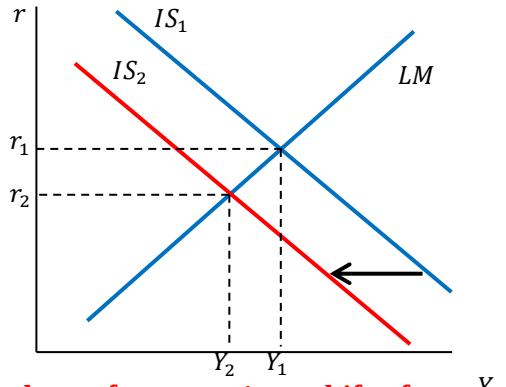
Figure 4: Question 2d: Consumption per capita



4. **IS-LM and Mundell-Fleming Model (20 points).**

a. Draw the IS- and LM-curves (for a closed economy) in the graph below. (Do not forget to label the axes.) Show what happens to output and the interest rate in the short run following a decrease in Government spending. Describe what happens to other components of expenditures (consumption and investment).

Government spending falls;
Planned expenditure falls; income (Y) and consumption (C) fall;
IS curve shift left
Lower income reduces demand for money
Interest rate (r) falls
Lower interest rate raises investment (I)



Total: 7 pts. [axes: 1 pt.; labelling of curves: 1 pt.; slope of curves: 1pt.; shift of curves: 2 pts.; change in C and/or I: 2 pts.]

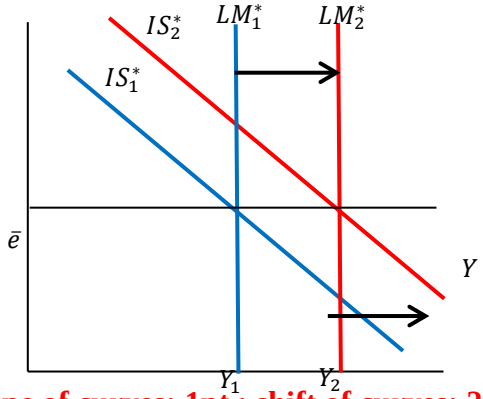
b. For the following shocks to the EU economy (assume the EU is a closed economy), show with a '+' or '-' what happens to the interest rate (r) and income (Y) in the short run.

	r	***Y***
i. Worldwide demand for German and Italian cars increases.	+	+
ii. The Central Bank increases the money supply through purchases of govt bonds.	-	+
iii. Households foresee better times ahead and increase their consumption.	+	+
iv. A new electronic payment system using smartphones becomes generally accepted for making transactions.	-	+

Total: 6 pts. [1.5 deduction for every wrong answer]

c. Consider a small open economy with a fixed exchange rate. Draw the IS* and LM* curves (label the axes) and show the effect of a decrease in taxes. Describe what happens to expenditures Y, its components, C, I, NX and to interest rate 'r' and exchange rate 'e'. (use + ,- , =. For example: Y=, C+, I-, ...)

Taxes fall; planned expenditure rises;
Income (Y) and consumption (C) rise;
Higher income raises demand for money;
To prevent increase in interest rate and
exchange rate (e), CB raises money supply;
Investments (I) and net exports (NX) thus remain constant



Total: 7 pts. [axes: 1 pt.; labelling of curves: 1 pt.; slope of curves: 1pt.; shift of curves: 2 pts.; change in C, NX, I and/or e, r, G: 2 pts.]

5. **AS-AD and Phillips-Curve (20 points).**

a. Does the short-run AS curve derived under the assumption of sticky wages slope upwards? Why?

Yes, the AS curve slopes upward, higher Y goes with higher P. If P rises more than expected, real wages fall and firms higher new workers. This implies higher production. (but countercyclical real wages do not seem to occur in most countries)

b. Write down the relationship between the price level and output in the sticky price model of aggregate supply. What happens to the slope of the $SRAS$ (short run aggregate supply) curve when the share of firms that can always adjust prices increases?

P = Pe + b (Y - Y_bar), with b = a (1-s)/s., with s is fraction sticky firms.
when more firms can adjust response of output to unexpected price change is smaller. So, AS is steeper.
s goes down, curve is steeper.
intuition. There a less firms that can't adjust prices and react with output.

c. Write down the Phillips curve and describe the trade-off that the Phillips curve implies. What happens to the Phillips curve, and the position of the economy on a Phillips curve in the short and long run after the Central Bank increases the growth rate of the money supply? (state which assumption you make about price expectations)

pi = pi^e - B (U - U_bar) + epsilon
Assume rational: after announcement, pi^e increases. U stays at U_bar and pi rises.
Assume adaptive: after announcement, income increases, U decreases. Expected inflation is equal to inflation before announcement. So, actual pi will increase.
But, as pi increases, pi^e goes up next year, curve shifts, and slowly U goes back to U_bar. Economy ends up with U=U_bar and higher pi. But, it had period of lower unemployment, during transition.