# Econ 002 – INTRO MACRO – Prof. Luca Bossi – March 18, 2013
## MIDTERM #2 SOLUTIONS

My signature below certifies that I have complied with the University of Pennsylvania's Code of Academic Integrity in completing this examination. In particular, I declare that I have not used a graphing calculator to complete this exam.

_____          _____

**Student Name (printed)**          **PennID**


_____          _____

**Signature**          **Date**


### INSTRUCTIONS


The exam is composed of 21 multiple choice questions and two exercises. Unless stated otherwise on the exam, all multiple choice questions are worth 3 points (the total is 60 points for the multiple choice part). The exercises are worth 20 points each (the total is 40 points for the exercise part). You can detach the answer sheet for the MC part at the end of the exam if this is more comfortable for you. If that is the case, be sure to put your name on it and to tell your TA to staple it back to the exam when finished.  If you do not fill in the MC part on time and request extra time at the end of the exam to write the answers up, a proctor will take your name and you will receive a penalty of 5 points.


### TOTAL POINTS = 100. TOTAL TIME = 60 minutes


**Provide your answers on the exam sheet directly. Read all questions very carefully. Write legibly.**


### EXAM TAKING POLICY

If you need to use the restroom, raise your hand and wait for the proctor to come to you.  Only one person can be out of the examination room at a time, and the proctor will hold onto your exam papers while you are out at the restroom.

**FOR THE DURATION OF THE EXAM, AND WITH THE EXCEPTION OF YOUR ALLOWED SCIENTIFIC CALCULATOR, YOU HAVE TO TURN OFF EVERYTHING ELSE THAT HAS A POWER BUTTON. NO CELL PHONES. NO BOOKS.  NO NOTES.  NO HELP SHEETS. NO TALKING TO EACH OTHER. YOU CANNOT CONNECT TO THE INTERNET.**
          <u>**NO ASKING THE PROCTORS ANY QUESTION OR HELP TO SOLVE THE EXAM.**</u>
**WRITE IN PENCIL OR IN PEN AS YOU LIKE, BUT IF YOU WRITE IN PENCIL THERE IS NO POSSIBILITY TO ASK FOR RE-GRADING. PLEASE WRITE YOUR NAME ON EVERY SINGLE PAGE OF THE EXAM.**
**PLEASE FOLLOW THE INSTRUCTIONS AS TO HOW TO SUBMIT YOUR EXAM AT THE END OF THE 60 MINUTES.**


### PLEASE DO NOT START THIS EXAM UNTIL INSTRUCTED TO DO SO.


## GOOD LUCK!

### MULTIPLE CHOICE QUESTIONS
**Identify the letter of the choice that best completes the statement or answers the question. Write your answer in the answer sheet for the MC provided on the last page of the exam.**

**1)** Alice says that the present value of $700 to be received one year from today if the interest rate is 6 percent is less than the present value of $700 to be received two years from today if the interest rate is 3 percent. Beth says that $700 saved for one year at 6 percent interest has a smaller future value than $700 saved for two years at 3 percent interest.
a.      Both Alice and Beth are correct.
b.      Both Alice and Beth are incorrect.
c.      Only Alice is correct.
d.      Only Beth is correct.

**2)** Consider three imaginary countries.  In Mainland, saving amounts to $4,000 and consumption amounts to $8,000; in Upland, saving amounts to $2,000 and consumption amounts to $15,000; and in Lowland, saving amounts to $6,000 and consumption amounts to $11,000.  The saving rate is
a.      higher in Mainland than in Lowland, and it is higher in Lowland than in Upland.
b.      higher in Lowland than in Mainland, and it is higher in Mainland than in Upland.
c.      higher in Lowland than in Upland, and it is the same in Upland and Mainland.
d.      higher in Mainland than in Upland, and it is the same in Mainland and Lowland.

**3)**  The country of Bienmundo does not trade with any other country. Its GDP is $30 billion. Its government purchases $5 billion worth of goods and services each year, collects $7 billion in taxes, and provides $3 billion in transfer payments to households. Private saving in Bienmundo amounts to $5 billion. What are consumption and investment in Bienmundo?
a.      $18 billion and $5 billion, respectively
b.      $21 billion and $4 billion, respectively
c.      $13 billion and $7 billion, respectively
d.      There is not enough information to answer the question.

**4)** In 2009, Modern Electronics, Inc. produced 60,000 calculators, employing 80 workers, each of whom worked 8 hours per day.  In 2010, the same firm produced 76,500 calculators, employing 85 workers, each of whom worked 10 hours per day.  Productivity at Modern Electronics
a.      decreased by 4%
b.      remained constant.
c.      increased by 8.33%
d.      increased by 27.50%

**5)** The Eye of Horus incense company has $10 million in cash which it has accumulated from retained earnings. It was planning to use the money to build a new factory. Recently, the rate of interest has increased. The increase in the rate of interest should
a.      not influence the decision to build the factory because The Eye of Horus doesn't have to borrow any money.

b.      not influence the decision to build the factory because its stockholders are expecting a new factory.
c.      make it more likely that The Eye of Horus will build the factory because a higher interest rate will make the factory more valuable.
d.      make it less likely that The Eye of Horus will build the factory because the opportunity cost of the $10 million is now higher.

**6)** If Japan goes from a small budget deficit to a large budget deficit, it will reduce
a.      private saving and so shift the supply of loanable funds left.
b.      investment and so shift the demand for loanable funds left.
c.      public saving and so shift the supply of loanable funds left.
d.      None of the above is correct.

**7)** Suppose that there are diminishing returns to capital and constant returns to scale. Suppose also that two countries are exactly the same except one has less capital and so less real GDP per person. Suppose that both increase their saving rate from 3 percent to 4 percent. It follows that
a.      both countries will have permanently higher growth rates of real GDP per person, and the growth rate will be higher in the country with more capital.
b.      both countries will have permanently higher growth rates of real GDP per person, and the growth rate will be higher in the country with less capital.
c.      both countries will have higher levels of real GDP per person, and the temporary increase in growth in the level of real GDP per person will have been greater in the country with more capital.
d.      both countries will have higher levels of real GDP per person, and the temporary increase in growth in the level of real GDP per person will have been greater in the country with less capital.

**8)** In some countries it is time consuming and costly to establish ownership of property.  Reforms to reduce these costs would likely
a.      have no affect on either real GDP nor productivity
b.      raise real GDP and productivity.
c.      raise real GDP but not productivity.
d.      raise productivity but not real GDP.

**9)** All else equal, if there are diminishing returns to labor and diminishing returns to capital, then what happens to productivity if both capital and labor increase by the same amount?
a.      Productivity will definitely fall.
b.      Productivity will definitely be unchanged.
c.      Productivity will definitely rise.
d.      None of the above are necessarily correct.

**10)** Diversification of a portfolio
a.      can eliminate market risk, but it cannot eliminate firm-specific risk.
b.      can eliminate firm-specific risk, but it cannot eliminate market risk.
c.      increases the portfolio's standard deviation.
d.      is not necessary for a person who is risk averse.

**11)** For a closed economy, GDP is $11 trillion, consumption is $7 trillion, taxes are $3 trillion and the government runs a surplus of $1 trillion. What are private saving and national saving?
a.　　$4 trillion and $1 trillion, respectively
b.　　$4 trillion and $5 trillion, respectively
c.　　$1 trillion and $2 trillion, respectively
d.　　$1 trillion and $1 trillion, respectively

**12)** Which of the following statements is correct?
a.　　The total income in the economy that remains after paying for consumption and government purchases is called private saving.
b.　　The sum of private saving and national saving is called public saving.
c.　　For a closed economy, the sum of private saving and public saving must equal investment.
d.　　For a closed economy, the sum of consumption, national saving, and taxes must equal GDP.

**13)** Crowding out is when investment declines because
a.　　a budget deficit makes interest rates rise.
b.　　a budget deficit makes interest rates fall.
c.　　a budget surplus makes interest rates rise.
d.　　a budget surplus makes interest rates fall.

**14)** In examining the national income accounts of the closed economy of Nepotocracy you see that this year it had taxes of $100 billion, transfers of $40 billion, and government purchases of goods and services of $80 billion. You also notice that last year it had private saving of $50 billion and investment of $70 billion. In which year did Nepotocracy have a budget deficit of $20 billion?
a.　　this year and last year
b.　　this year but not last year
c.　　last year but not this year
d.　　neither this year nor last year

**15)** Suppose a country has a consumption tax that is similar to a state sales tax. If its government were to eliminate the consumption tax and replace it with an income tax that includes an income tax on interest from savings, what would happen?
a.　　There would be no change in the interest rate or saving.
b.　　The interest rate would decrease and saving would increase.
c.　　The interest rate would increase and saving would decrease.
d.　　None of the above is correct.

**16)** Suppose you will receive $500 at some point in the future.  If the annual interest rate is 7.5 percent, then the present value of the $500 is
a.　　$411.26 if the $500 is to be received in 5 years and $338.95 if the $500 is to be received in 10 years.
b.　　$348.28 if the $500 is to be received in 5 years and $242.60 if the $500 is to be received in 10 years.
c.　　$291.11 if the $500 is to be received in 5 years and $272.89 if the $500 is to be received in 10 years.
d.　　$291.11 if the $500 is to be received in 5 years and $236.49 if the $500 is to be received in 10 years.

**17)** The president of a poor country has announced that he will implement the following measures which he claims are designed to increase growth: 1. Reduce corruption in the legal system; 2. Reduce reliance on market forces because they allocate goods and services in an unfair manner; 3. Restrict investment in domestic industries by foreigners because they take some of the profits out of the country; 4. Encourage trade with neighboring countries; and 5. Increase the fraction of GDP devoted to consumption. How many of these measures will have a positive effect on growth?

a.      1
b.      2
c.      3
d.      4

**18)** You may be unwilling to buy a used car because you suspect the last owner found out the car was a lemon. You may treat a car you rented with a little less care than you'd use on your own car.

a.      Both examples primarily illustrate adverse selection.
b.      Both examples primarily illustrate moral hazard.
c.      The first example primarily illustrates adverse selection; the second primarily illustrates moral hazard.
d.      The first example primarily illustrates moral hazard; the second primarily illustrates adverse selection.

**19)** On the Internet you find the following offers for opening an online account.  Which of them is the best offer if you want to deposit $5000 in an account today, to be withdrawn two years later?

a.      an interest rate of 5 percent, with the bank charging you a $50 processing fee at the time you open your account
b.      an interest rate of 4 percent, with the bank giving you a $65 bonus at the time you open your account
c.      an interest rate of 3.5 percent, with the bank giving you a $100 bonus to open your account
d.      an interest rate of 4.5 percent, with no processing fee and no bonus

**20) (2 POINTS)** According to the assigned reading I gave you: "**The current situation for US deficit and debt**", to stabilize the debt over the coming decade US needs:

a.  $1.8 Trillion in Deficit Savings.
b.  $1.7 Trillion in Deficit Savings.
c.  $1.6 Trillion in Deficit Savings.
d.  $1.5 Trillion in Deficit Savings.

**21) (1 POINT)** A, B, C or D? (pick wisely ☺ one if you want one point)
a.  b.  c.  d.
**EVERYONE GETS ONE POINT HERE. ☺**

To get full credits in the exercises below you really need to show your work. If you write just a number as the answer and even if that number is correct you will not get full credits in the exercise unless you show fully the formulas and your work (how you got that number and the reasoning involved in your computation).

**EXERCISE I (20 points)**
This exercise is divided in 2 sub-parts that are totally separate and independent from each other.

**Part A) (10 POINTS)** We are in 2013. The current outstanding US budget debt is around $16 Trillion. The current US budget deficit is around $900 billion a year. The current nominal interest rate is equal to the real interest rate at 2% per year. If there are no changes whatsoever neither in the tax revenue code nor in government spending habits so that the government deficit will have the same magnitude as of today for the next foreseeable future, what will be the budget debt 3 years from now, in 2016, when you graduate? Inflation is projected to be 1 percentage point higher in 2014 than it is in 2013, 1 percentage point higher in 2015 than it is in 2014, and 1 percentage point higher in 2016 than it is in 2015. Use 2 decimals for your answer.

You just need to use the formula for budget debt:
$$B_t = DE_t + (1 + i) * B_{t-1}$$
recursively. The key is to remember that the interest rate in the formula is the nominal interest rate which is equal to real interest rate plus inflation. Hence, inflation in 2013 is zero %.
$$B_{2014} = DE_{2014} + (1 + 2\% + 1\%) * B_{2013}$$
$$B_{2015} = DE_{2015} + (1 + 2\% + 1\% + 1\%) * B_{2014}$$
$$B_{2016} = DE_{2016} + (1 + 2\% + 1\% + 1\% + 1\%) * B_{2015}$$

You are told that $B_{2013} = \$16\ trillion$
You are told that $DE_{2013} = DE_{2014} = DE_{2015} = DE_{2016} = \$900\ billion$ (because the tax code and the spending will not change). Expressing in trillion $:
$$B_{2014} = 0.9 + (1 + 0.03) * 16 = 17.38$$
$$B_{2015} = 0.9 + (1 + 0.04) * 17.38 = 18.98$$
$$B_{2016} = 0.9 + (1 + 0.05) * 18.98 = 20.82$$

**Part B) (10 POINTS)** Consider a closed economy. In this economy data for 2012 show that, the output target, $Y^N$, is 500,000$.
Income Tax revenues are $T_{2012} = \tau_{2012} * Y_{2012} = 0.5 * Y_{2012}$
Transfers are $Tr_{2012} = u_{2012} * (Y^N - Y_{2012}) = 0.10 * (Y^N - Y_{2012})$
Government spending, G, is 1000 and the investment function is I = 900 - 10*r.
The consumption function is C = 500 + 0.3*$Y_D$ where $Y_D$ stands for disposable income of 2012.
If the government spending were to increases by 1$, and the tax rate is the same and nothing else is changed, what is the government spending multiplier? Use 2 decimals if needed.

**Answers:**
**a) First we need to solve for the level of GDP without government spending increase.**
**We know that Y = C + I + G + NX and NX =0.**
**Also we know that, by the definition of disposable income,**

$$C = 500 + 0.3*(Y - T + Tr) = 500 + 0.3 * ((1 - \tau_{2012} - u_{2012}) * Y_{2012} + u_{2012} * Y^N)$$
$$C = 500 + 0.3 * 0.4 * Y_{2012} + 0.3 * 0.1 * 500,000 = 15,500 + 0.12 * Y_{2012}$$

**Going back to our equation for GDP according to the expenditure approach:**
$$Y_{2012} = C + I + G = 15,500 + 0.12 * Y_{2012} + 900 - 10 * r + 1000$$

**Solving for $Y_{2012}$:**

**0.88*$Y_{2012} = 17,400 - 10 * r$**
$$Y_{2012} = 19,772.73 - 11.36 * r$$

**Now we need to compute the level of GDP with the government spending increase and assess the effect. The consumption function and the investment demand function are still the same:**

$$C = 15,500 + 0.12 * Y_{2012}$$
$$I = 900 - 10 * r$$

**But now G = 1001, hence:**
$$Y_{2012} = C + I + G = 15,500 + 0.12 * Y_{2012} + 900 - 10 * r + 1001$$

**Solving for $Y_{2012}$:**

**0.88*$Y_{2012} = 17,401 - 10 * r$**
$$Y_{2012} = 19,773.86 - 11.36 * r$$

**By looking at the level of income before the government spending increase, we can conclude that for any level of the interest rate, the 1$ increase in government spending induces an increase in output of $1.13. Hence the government spending multiplier is 1.13.**

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**EXERCISE II (20 points)**
The country of Leprechaunia is a closed economy that can be represented through the standard Solow model we have studied in class. The production function is given by the Cobb-Douglas expression:
$$Y_t = AK_t^{\alpha}L_t^{1-\alpha}$$
With $K_t > L_t$ at every time period t.
You are given the following information for the economy of Leprechaunia: α = 0.5, n = 2%, A = 2, d = 18%. Where n stands for the population growth rate, A is technology; d is the depreciation rate.
The tweak in the model comes from the fact that the saving rate is not constant anymore. The Leprechauns decide to save as a function of their physical capital per capita. In particular, the expression for the saving rate is: $s = \dfrac{1}{\left(\frac{K_t}{L_t}\right)^{\alpha}}$

**a) (12 POINTS)** Find the value of the steady state level of physical capital per person of Leprechaunia. Use 2 decimals if needed.

**Output per person is:**
$$\frac{Y_t}{L_t} = \frac{AK_t^{\alpha}L_t^{1-\alpha}}{L_t} = A\left(\frac{K_t}{L_t}\right)^{\alpha}$$

**With the small caps convention of representing per capita variables, the expression above becomes:**
$$y_t = A(k_t)^{\alpha}$$
**Using this info into the fundamental equation, we get:**
$$k_{t+1}(1+n) = sA(k_t)^{\alpha} + (1-d)k_t = \frac{1}{(k_t)^{\alpha}}A(k_t)^{\alpha} + (1-d)k_t = A + (1-d)k_t$$

**In steady state we know that:**
$$k_{t+1} = k_t = \bar{k}$$
**Plug this into the fundamental equation to obtain:**
$$0 = A - (n+d)\bar{k}$$
**Solving for $\bar{k}$:**
$$\bar{k} = \frac{A}{n+d}$$
**Plugging the values for the parameters:**
$$\bar{k} = \frac{A}{n+d} = \frac{2}{0.02+0.18} = 10$$

**b) (8 POINTS)** A corrupted government comes into power. They impose a tax on total savings of 10%. The revenues from the tax are not used to finance government spending, but rather government officials use those revenues for their own private consumption. Find the value of the steady state level of consumption per capita of Leprechaunia under the new tax. Use 2 decimals if needed.
**Now savings/investment per capita is going to be only 90% of what they used to be. This changes the level of physical capital per capita of steady state. Using this info into the fundamental equation, we get:**

$$k_{t+1}(1 + n) = 0.9 * sA(k_t)^\alpha + (1 - d)k_t = 0.9 * \frac{1}{(k_t)^\alpha} A(k_t)^\alpha + (1 - d)k_t = 0.9 * A + (1 - d)k_t$$

**In steady state we know that:**

$$k_{t+1} = k_t = \bar{k}$$

**Plug this into the fundamental equation to obtain:**

$$0 = 0.9 * A - (n + d)\bar{k}$$

**Solving for $\bar{k}$:**

$$\bar{k} = \frac{0.9 * A}{n + d}$$

**Plugging the values for the parameters:**

$$\bar{k} = \frac{0.9 * A}{n + d} = \frac{0.9 * 2}{0.02 + 0.18} = 9$$

**Now, we need to find the value of output per worker in steady state. Using:**

$$y_t = A(k_t)^\alpha$$

**We can write:**

$$\bar{y} = A(\bar{k})^\alpha = 2(9)^{0.5} = 6$$

**Now in the Solow model income (production) can only be consumed or saved so before the tax we had:**
**$Y_t = C_t + S_t = C_t + sY_t$**
**After the tax is introduced:**

$$Y_t = C_t + 0.9 * sY_t$$

**Hence: $C_t = (1 - 0.9 * s)Y_t$**

**The saving rate of steady state is: $s = \frac{1}{(\bar{k})^\alpha} = \frac{1}{(9)^{0.5}} = \frac{1}{3}$**

**Rewriting this for the steady state value in per capita variables:**

$$\bar{c} = (1 - 0.9 * s)\bar{y} = \left(1 - 0.9 * \frac{1}{3}\right) * 6 = 0.7 * 6 = 4.2$$

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**YOUR NAME:** _____

**YOUR TA's NAME:**_____

**WRITE THE LETTER OF YOUR CHOICE FOR THE MULTIPLE CHOICE QUESTIONS HERE; <u>ONLY THIS PAGE WILL BE GRADED FOR THE MC PART.</u>**

| | | | |
|---|---|---|---|
| 1) | 6) | 11) | 16) |
| 2) | 7) | 12) | 17) |
| 3) | 8) | 13) | 18) |
| 4) | 9) | 14) | 19) |
| 5) | 10) | 15) | 20) |
| | | | 21) |