Econ 002- INTRO MACRO Prof. Luca Bossi   March 21, 2016
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**

_____   _____

Your Signature   **Your TA Name (printed)**

INSTRUCTIONS

The exam is closed book. The exam is composed of 20 multiple-choice questions and two exercises. Unless stated otherwise, 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. Please follow the instructions as to how to submit your exam at the end of the 60 minutes. If you do not follow those instructions and/or delay your exam submission, a proctor will take your name and you will receive a penalty that will depend on your (miss)behavior.

ANSWER ALL QUESTIONS. 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. NO ASKING THE PROCTORS ANY QUESTION OR HELP TO SOLVE THE EXAM. YOU CANNOT CONNECT TO THE INTERNET.

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 THE FIRST PAGE OF THE EXAM AND ON THE MC BUBBLE PAGE.

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

GOOD LUCK!

MULTIPLE CHOICE QUESTIONS

Identify the letter that best completes the statement or answers the question. Mark your answer (fill in the letter of your choice) in the answer bubble sheet for the MC provided on the last page of the exam.

1) When a closed economy saves a larger portion of its GDP than it did before, it will have
a.   more capital and higher labor productivity.
b.   more capital and lower labor productivity.
c.   less capital and higher labor productivity.
d.   less capital and lower labor productivity.

2) We would expect the interest rate on Bond A to be higher than the interest rate on Bond B if the two bonds have identical characteristics except that
a.   the credit risk associated with Bond A is lower than the credit risk associated with Bond B.
b.   Bond A was issued by the city of Philadelphia and Bond B was issued by Red Hat Corporation.
c.   Bond A has a term of 20 years and Bond B has a term of 2 years.
d.   All of the above are correct.

3) If the government's expenditures exceeded its receipts, it would likely
a.   lend money to a bank or other financial intermediary.
b.   borrow money from a bank or other financial intermediary.
c.   buy bonds directly from the public.
d.   sell bonds directly to the public.

4) Suppose that in a closed economy GDP is equal to 11,000, taxes are equal to 2,500 consumption equals 7,500 and government purchases equal 2,000. What are private saving, public saving, and national saving?
a.   1,500, 1,000, and 500, respectively
b.   1,000, 500, and 1,500, respectively
c.   500, 1,500, and 1,000, respectively
d.   None of the above is correct.

5) Other things the same, when the interest rate rises, the present value of future revenues from investment projects
a.   rises, so investment spending rises.
b.   falls, so investment spending rises.
c.   rises, so investment spending falls.
d.   falls, so investment spending falls.

6) For an imaginary closed economy, T = $5,000; S = $11,000; C = $50,000; and the government is running a budget deficit of $1,000. Then
a.   private saving = $10,000 and GDP = $54,000.
b.   private saving = $10,000 and GDP = $58,000.
c.   private saving = $12,000 and GDP = $67,000.
d.   private saving = $12,000 and GDP = $72,000.

7) Two economists estimate the government expenditure multiplier and come up with different results. One estimates the multiplier at 0.8, while the other comes up with an estimate of 1.25. Explain why these estimates are different in terms of the assumptions that each economist is making.

a. Compared to the first economist, the second economist is assuming a longer time frame for the effects of the increased expenditure to be observed.

b. Compared to the first economist, the second economist must be assuming either a larger induced increase in consumption, a smaller crowding out effect, or both.

c. Compared to the first economist, the second economist must be assuming either a smaller induced increase in consumption, a larger crowding out effect, or both.

d. Unlike the first economist, the second economist must be assuming that the government expenditure is devoted to useful projects.

8) Suppose that there are diminishing returns to capital. Suppose also that two countries are the same except one has more capital per worker and so it has more real GDP per worker than the other. Finally, suppose that the savings rate in both countries increase from 4% to 7%. In the next ten years, following this increase, we would expect that

a. the growth rate will not change in either country.

b. the country that started with less capital per worker will grow faster.

c. the country that started with more capital per worker will grow faster.

d. both countries will grow and at the same higher rate.

9) Educated people may generate ideas that increase production. These ideas

a. may produce a return to society from education that is greater than the return to the individual.

b. could justify government subsides for education.

c. are external benefits of education.

d. All of the above are correct.

10) A larger budget surplus

a. reduces the interest rate and raises investment.

b. reduces the interest rate and investment.

c. raises the interest rate and reduces investment.

d. raises the interest rate and investment.

11) Which of the following are effects of an increased budget deficit?

a. at any interest rate the supply of loanable funds is less; a higher interest rate rises private saving

b. the supply of loanable funds does not change; a higher interest rate rises private saving

c. at any interest rate the supply of loanable funds is less; a higher interest rate reduces private saving

d. the supply of loanable funds does not change; a higher interest rate reduces private saving

Figure 1. On the horizontal axis of the graph, *L* represents the quantity of loanable funds in billions of dollars. On the vertical axis we have the real interest rate.
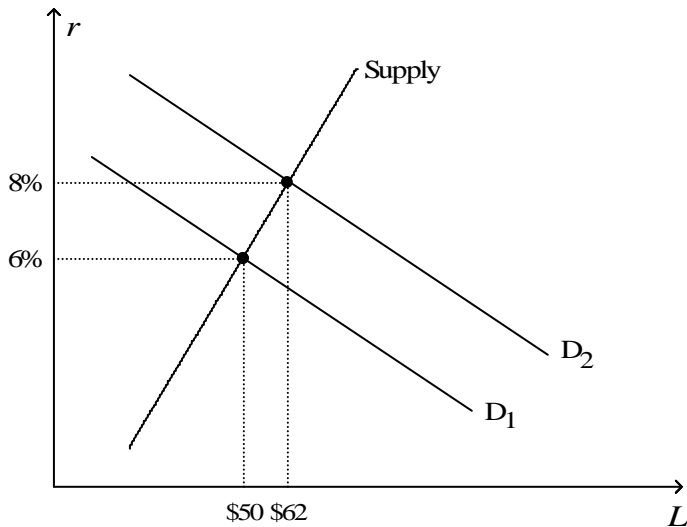
12) Refer to Figure 1. The position and/or slope of the Supply curve are influenced by
a.   the level of public saving.
b.   the level of national saving.
c.   decisions made by people who have extra income they want to save and lend out.
d.   All of the above are correct.

13) Refer to Figure 1. Regard the position of the Supply curve as fixed, as on the graph. If the real interest rate is 8 percent, the inflation rate is 3 percent, and the market for loanable funds is in equilibrium, then the position of the demand-for-loanable-funds curve must be
a. D_1.
b. D_2.
c.   between D_1 and D_2.
d.   to the right of D_2.

14) Refer to Figure 1. If the equilibrium quantity of loanable funds is $56 billion and if the rate of inflation is 4 percent, then the equilibrium real interest rate is
a.   lower than 6 percent.
b.   6 percent.
c.   between 6 percent and 8 percent.
d.   higher than 8 percent.

15) The slope of the demand for loanable funds curve represents the
a.   positive relation between the real interest rate and investment.
b.   negative relation between the real interest rate and investment.
c.   positive relation between the real interest rate and saving.
d.   negative relation between the real interest rate and saving.

16) If the best educated and most skilled persons leave a country, then in the short term this country's human capital per worker

a. and physical capital per worker will increase.

b. and physical capital per worker will decrease.

c. will increase but physical capital per worker will decrease.

d. will decrease but physical capital per worker will increase.

17) The problem of moral hazard arises because

a. life is full of all sorts of risks.

b. after people buy insurance, they have less incentive to be careful about their risky behavior.

c. a high-risk person is more likely to apply for insurance than is a low-risk person.

d. insurance companies go to great effort to avoid paying claims to their policyholders.

18) Which of the following is adverse selection?

a. the risk associated with selecting stocks in only a few specific companies

b. the risk that a person will become overconfident in his ability to select stocks

c. a high-risk person being more likely to apply for insurance

d. after obtaining insurance a person having less incentive to be careful

19) Suppose that interest rates unexpectedly rise and that Carter Corporation announces that revenues from last quarter were down but not as much as the public had anticipated they would be down. According to the efficient markets hypothesis, which of the things make the price of Carter Corporation Stock fall?

a. both the interest rate rising and the revenue announcement

b. neither the interest rate rising nor the revenue announcement

c. only the interest rate rising

d. only the revenue announcement

20) (Attendance) When we discussed the investment demand curve in class and the tradeoffs that firms face when buying capital goods, the professor gave an in class example concerning an IT firm buying a whole building in NYC for its new headquarters. That firm was:

a. Google.

b. Spotify.

c. Apple.

d. Samsung.

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 steps involved in your computation).

EXERCISE I (20 POINTS TOTAL)
This exercise is divided in 2 sub-parts that are <u>totally separate and independent</u> from each other.

Part I (10 POINTS TOTAL)
a) (4 POINTS) Consider the Barbell economy with the following characteristics:

Period	Capital	Adult Population	Labor Force	LFPR	Natural Rate of Unemployment	Current Rate of Unemployment
t	19	40	20	50%	5%	10%

Assume that the production function is given by the Cobb-Douglas expression
$$Y_t = F(K_t, L_t) = K_t^{0.3} L_t^{0.7}$$
Also you know that in Barbell the natural rate of output is:
$$Y_{t,N} = F(K_t, L_{t,N})$$
Where
$L_{t,N}$ =number of workers when the economy is at the natural rate of unemployment
$Y_{t,N}$ = natural rate of output
Find the <u>output gap</u> in period t for the Barbell economy. <u>Use 2 decimal digits precision for your computations.</u>
b) (6 POINTS) Now let's continue with the Barbell economy. Suppose that in this economy taxes at time t are 15% of its output. Government spending at time t is 20% of its output. Transfer payments are as follow:
Social Security disbursements = 2% of the natural rate of output.
Unemployment benefits = 3% of the negative of output gap.
Compute the cyclical primary budget deficit/surplus for this economy in period t. <u>Use 2 decimal digits precision for your computations.</u>
 (Hint: if you could not figure out what the numbers for the current and natural level of output are in part a) above, please set $Y_t = 1$ and $Y_{t,N} = 2$ for this part and you will not be penalized <u>IF all your other computations and formulas are correct</u>).

<div align="center">PAPER FOR YOUR USE</div>

Answers:
Part I
a) The output gap is formally defined as $Y_t - Y_{t,N}$.
When the economy is an the natural rate of unemployment, there is 1 unemployed person (5% of labor force which is 20). This means that there are 19 people working (95% of labor force). Hence from the Cobb-Douglas production function: $Y_{t,N} = 19^{0.3} 19^{0.7} = 19$.
However, the current rate of unemployment is 10% so there are only 18 people working currently (90% of labor force). Hence, $Y_t = 19^{0.3} 18^{0.7} = 18.29$.
$$Y_t - Y_{t,N} = -0.71$$

b) In order to compute the cyclical primary budget deficit, we need to compute the actual primary budget deficit, DE, and the structural primary budget deficit DE* for period t (i.e. the deficit that would occur if output at period t were to be at its natural rate). We need to recall the formula for the actual primary budget deficit:

$$DE_t = G_t + Tr_t - T_t$$

So:
$$DE_t = G_t + SS_t + u_t * (Y_{t,N} - Y_t) - \tau_t * Y_t = 0.2 * Y_t + 0.02 * Y_{t,N} + 0.03 * (Y_{t,N} - Y_t) - 0.15 * Y_t$$
$$= 0.2 * 18.29 + 0.02 * 19 + 0.03 * (0.71) - 0.15 * 18.29 = 1.32$$

And for the structural budget deficit we just need to use $Y_t = Y_{t,N}$:
$$DE_t^* = 0.2 * Y_{t,N_t} + 0.02 * Y_{t,N} + 0 - 0.15 * Y_{t,N} = 0.07 * Y_{t,N} = 0.07 * 19 = 1.33$$

The cyclical primary budget deficit is $DE_t - DE_t^* = 1.32 - (1.33) = -0.01$

<u>If you did not know/could not find the level of output and natural rate of output from part b) then you should have set:</u>

$$Y_t = 1 \text{ and } Y_{t,N} = 2$$

So:
$$DE_t = G_t + SS_t + u_t * (Y_{t,N} - Y_t) - \tau_t * Y_t = 0.2 * Y_t + 0.02 * Y_{t,N} + 0.03 * (Y_{t,N} - Y_t) - 0.15 * Y_t$$
$$= 0.2 * 1 + 0.02 * 2 + 0.03 * (1) - 0.15 * 1 = 0.12$$

And for the structural budget deficit we just need to use $Y_t = Y_{t,N}$:
$$DE_t^* = 0.2 * Y_{t,N_t} + 0.02 * Y_{t,N} + 0 - 0.15 * Y_{t,N} = 0.07 * Y_{t,N} = 0.07 * 2 = 0.14$$

The cyclical primary budget deficit is $DE_t - DE_t^* = 0.12 - (0.14) = 0.02$

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Part II (10 POINTS TOTAL)
Consider a closed economy. In this economy the output target is Y_N.
Income Tax revenues are $T = \tau * Y$ with $0 < \tau < 1$
Unemployment benefit transfers are $Tr = u * (Y_N - Y)$ with $0 < u < 1$
Social Security transfers are $SS = s * Y$ with $0 < s < 1$
Government spending, G, is 1000 and the investment function is
$I = d * Y$ with $0 < d < 1$
The consumption function is
C = a + b*Y_D where Y_D stands for disposable income and $0 < b < 1, a > 0$
What is the formula for the government spending multiplier in this economy? <u>Show your work.</u>

Part II
First we need to recall the formula of GDP according to the expenditure approach.
We know that

$$Y = C + I + G + NX \text{ and } NX = 0.$$

Also we know that, by the definition of disposable income,

$$Y_D = Y - T + Tr + SS = Y - \tau * Y + u * (Y_N - Y) + s * Y$$

Notice: Social Security payments are transfers so they need to be part of the disposable income.

Plugging this into the consumption function:
C = $a + b*(Y - \tau * Y + u * (Y_N - Y) + s * Y) = a + b * ((1 - \tau - u + s) * Y + u * Y_N)$
Going back to our equation for GDP according to the expenditure approach and plugging in all the info we know:

$$Y = C + I + G = a + b * ((1 - \tau - u + s) * Y + u * Y_N) + d * Y + 1000$$
$$Y = a + b * ((1 - \tau - u + s) * Y + u * Y_N) + d * Y + 1000$$

Solving for Y:

$$Y - d * Y - b * (1 - \tau - u + s) * Y = a + b * u * Y_N + 1000$$
$$(1 - d - b(1 - \tau - u + s)) * Y = a + b * u * Y_N + 1000$$

$$Y = \frac{a + b * u * Y_N + 1000}{(1 - d - b(1 - \tau - u + s))}$$

From the expression above we can clearly see that If the government spending increases by 1\$ (i.e. G goes from 1000\$ to 1001\$), then GDP increases by:

$$\frac{1}{(1 - d - b(1 - \tau - u + s))}$$

This is the formula for the government spending multiplier in this economy.
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EXERCISE II (20 POINTS TOTAL)

a) (14 POINTS) Your miserly uncle Scrooge McDuck has arrived in town just in time to witness the birth of your sister's daughter. Always in the entrepreneurial spirit, McDuck has offered the following deal to help fund your new niece's college plans. His proposal is that your sister will need to make six payments to McDuck's fund according to the following schedule:

First birthday of your niece: $800
Second birthday: $800
Third birthday: $900
Fourth birthday: $900
Fifth birthday: $1,000
Sixth birthday: $1,000
After the sixth birthday, there will be no more payments.
When your niece turns 65 years old, she will receive $350,000.
Assume the interest rate compounds annually and that it is 11% for the first 6 years of payments and 7% for all later years.

Is Scrooge McDuck offering a good deal to your sister? Or is she better off refusing the deal? Please illustrate every detail of your computations for the answer you provide. <u>Use 2 decimal digits precision for your computations.</u>

b) (6 POINTS) During his stay, you take Scrooge McDuck to the racetrack, and the both of you decide to bet money on horses. There are six horses. Each one has a name given by the letter A through E. The probability that each horse finishes first is given below. The prize for the top finisher is set at $750,000.
A => 0.34
B => 0.23
C = >0.28
D => 0.08
E => 0.07
Scrooge McDuck bets on horse A to win, and you decide to bet on horse B, D, or E to win.
If McDuck's horse doesn't win, he loses $350,000, and if none of your horses win, you lose $390,000. Only winning pays a prize (horses' placements do not matter). Compute the expected return and the standard deviation of the bet for Scrooge McDuck and yourself. Please illustrate the details of your computations for the answer you provide. <u>Use 2 decimal digits precision for your computations.</u>

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Answers:
a) Using the future value formula for each birthday:

FV1 = $800 (1.11)^5 = $1,348.05
FV2 = $800 (1.11)^4 = $1,214.46
FV3 = $900 (1.11)^3 = $1,230.87
FV 4= $900 (1.11)^2 = $1,108.89
FV5 = $1,000 (1.11)^1 = $1,110

Since there is a $1,000 payment at the sixth birthday, FV1 + FV2 + FV3 + FV4 + FV5 + 1,000 = $7,012.26
This is the future value of the payments when your niece turns six years old, then it must be converted to the future value at year 65, using the new interest rate. Note the 7% interest rate compound for 59 years because T = 59 = 65-6:
FV = $7,012.26 $(1.07)^{59}$ = $379,752.76

Compare this to the future value of the lump sum $350,000 at 65 years, and you see that your sister will be making more payments than it will be worth it.

Answer: Not a good deal for your sister.

Alternatively you could have used the PV method (rather than the FV) and determined the difference between the total present value of the payments to McDuck and the present value of the payments from McDuck.

PV of payments to McDuck=
$800/1.11 + $800/$(1.11)^2$ + $900/$(1.11)^3$ + $900/$(1.11)^4$ + $1,000/$(1.11)^5$ + $1,000/$(1.11)^6$
= $3,749.04

PV of $350,000 = $350,000 / $(1.07)^{59}$ = $6,462.87
But this amount must be discounted at the 11% interest rate in the first six years:

PV of $6,462.87 = $6,462.87 / $(1.11)^6$ = $3,455.31

Now taking the difference between the present value of the payments to McDuck and the present value of the payments from McDuck, we obtain $293.73.
Again, this deal is not worth it. Same answer as above with a different numerical computation.

b)
McDuck:
Expected winnings = probability of win * prize in case of win = 0.34 * $750,000 = $255,000
Expected losses = probability of loss * size of loss = (1-0.34) * $350,000 = $231,000
Average (Net) Expected Winnings: $24,000
Variance of the bet = 0.34*$(750,000-24,000)^2$+0.66*$(-350,000-24,000)^2$.
Taking the square root of 0.34*$(750,000-24,000)^2$+0.66*$(-350,000-24,000)^2$ = 521,079.65

You:
Expected Winnings = 0.23 * $750,000 + 0.08 * $750,000 + 0.07 * $750,000
= (0.23 + 0.08 + 0.07) $750,000 = 0.38*$750,000 = $285,000
Expected losses = (1 – 0.38)*$390,000 = $241,800
Net (Average) Expected Winnings: $43,200
Variance of the bet = 0.38*$(750,000-43,000)^2$+0.62*$(-390,000-43,200)^2$.
Taking the square root of 0.38*$(750,000-43,000)^2$+0.62*$(-390,000-43,200)^2$ = 553,340.55

YOUR NAME: _____ _____   YOUR TA's NAME:_____

MARK CLEARLY (FILL IN) THE LETTER OF YOUR CHOICE FOR THE MULTIPLE CHOICE QUESTIONS. <u>ONLY THIS PAGE WILL BE GRADED FOR THE MC PART.</u>

1.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

2.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

3.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

4.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

5.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

6.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

7.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

8.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

9.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

10.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

11.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

12.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

13.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

14.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

15.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

16.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

17.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

18.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

19.   Ⓐ   Ⓑ   Ⓒ   Ⓓ

20.   Ⓐ   Ⓑ   Ⓒ   Ⓓ