Suggested answer of Problem set #7

question 1 on page 323

(a)When government purchases increases, then the analysis of the Keynesian cross shows that GDP increases by an amount equal to [1/(1 – MPC)]ΔG.

(b)When the government increases taxes, then GDP changes by [– MPC/(1 – MPC)]ΔT.

(c) When the government increases G and T simultaneously by the same amount, for example, by ΔG, the total effect is the sum of 1/(1-MPC) and -MPC/
(1-MPC). Thus, the sum of those two are

$$\frac{1}{1-mpc}\Delta G - \frac{mpc}{1-mpc}\Delta G = 1$$

Thus GDP increases by ΔG. There is no multiplier effect.

Question 4 on page 234

(a) Demand for real money balances, L, is L=1000-100r. Usually, when we draw the demand and supply, we measure the price on the vertical axis and the quantity for the horizontal axis Thus, we can rewrite the real money demand as follows:

$$\begin{aligned} 100r &= 1000 - L \\ r &= 10 - \frac{1}{100}L \end{aligned}$$

Thus, the vertical intercept is 10 and the slope if -1/1000.

As for the real money supply, M=1000 and P=2. Thus, M/P=500. Therefore,the real money supply is the vertical line at 500.

(b). At the equilibrium, the real money demand and real money supply are equal. Thus, L=500.

$$r = 10 - \frac{500}{100} = 10 - 5 = 5$$

Thus, the equilibrium interest is 5%.

(c)When M is increased to 1200. M/P=1200/2=600. When, L=600, r becomes

$$r = 10 - \frac{600}{100} = 10 - 6 = 4$$

(d) When the Fed want to set r=7, then, from the demand for

$$\begin{aligned} L &= 1000 - 100r \\ &= 1000 - 100 * 7 \\ &= 300 \end{aligned}$$

This means that real money supply should be equal to 300. Thus, M/P=300. Since P=2, we have M=600.

Question 5 on page 324

(a), Y is GDP, I is investment, C is the consumption, r is interest rate, G is the government expenditure, T is the amount of tax, M is the money supply, P is the price level

(b) For IS curve, use the following equations:

$$\begin{aligned} Y &= C + I + G \\ I &= 100 - 10r \\ C &= 120 + 0.5(Y - T) \\ T &= 40 \\ G &= 50 \end{aligned}$$

Then, we have

$$\begin{aligned} Y &= 120 + 0.5(Y - 40) + 100 - 10r + 50 \\ Y &= 120 + 0.5Y - 20 + 100 - 10r + 50 \\ Y &= 250 + 0.5Y - 10r \\ 0.5Y &= 250 - 10r \\ Y &= 500 - 20r \end{aligned}$$

For drawing IS curve, we measure r on the vertical axis. Thus, we solve for r

$$\begin{aligned} 20r &= 500 - Y \\ r &= 25 - \frac{1}{20}Y \end{aligned}$$

Thus, the vertical intercept is 25 and the slope if -1/20.

(c) To derive the LM curve, we use

$$\begin{aligned} M/P^d &= Y - 20r \\ P &= 2 \\ M &= 600 \end{aligned}$$

Thus, we have

$$300 = Y - 20r$$

Solving for r, we have

$$\begin{aligned} 20r &= Y - 300 \\ r &= \frac{1}{20}Y - 15 \end{aligned}$$

Thus, the vertical intercept is -15 and the slope if 1/20.

(d) From the IS curve and LM curve, we have

$$\begin{aligned} r &= 25 - \frac{1}{20}Y \\ r &= \frac{1}{20}Y - 15 \end{aligned}$$

Therefore, we have

$$\begin{aligned} 25 - \frac{1}{20}Y &= \frac{1}{20}Y - 15 \\ 40 &= \frac{1}{10}Y \\ 400 &= Y \\ r &= \frac{1}{20}400 - 15 \\ r &= 20 - 15 \\ r &= 5 \end{aligned}$$

Thus, the equilibrium GDP is 400 and the interest rate is 5 percent.

Question 1 on page 350
a. false. It is not about LM curve
b. true
c. false it is not about IS curve
d. true
e. true
f. true

Question 2 on page 350
1. question 1

(a) If the central bank increases the money supply, then the LM curve shifts downward. Income increases and the interest rate falls. The increase in disposable income causes consumption to rise; the fall in the interest rate causes investment to rise as well.

(b)If government purchases increase, then the government-purchases multiplier tells us that the IS curve shifts to the right by an amount equal to [1/(1 – MPC)]ΔG. Income and the interest rate both increase. The increase in disposable income causes consumption to rise, while the increase in the interest rate causes investment to fall.

(c)If the government increases taxes, then the tax multiplier tells us that the IS curve shifts to the left by an amount equal to [– MPC/(1 – MPC)]ΔT. . Income and the interest rate both fall. Disposable income falls because income is lower and taxes are higher; this causes consumption to fall. The fall in the interest rate causes investment to rise.

(d)When the government increases the government expenditure and tax by the same amount, the total effect becomes

$$\frac{1}{1 - MPC} + \frac{-MPC}{1 - MPC} = 1$$

Thus, multiplier is equal to one. In another words, when the government increase the government expenditure by ΔG and finance it by the increased tax, then the GDP increases by ΔG. Thus, there is no multiplier effect.

Question 3 on page 350

3. Question 3.

(a) The IS curve is given by:

Y = C(Y – T) + I(r) + G.

We can plug in the consumption and investment functions and values for G and T as given in the question and then rearrange to solve for the IS curve for this economy:

Y = 200 + 0.75(Y – 100) + 200 – 25r + 100

Y – 0.75Y = 425 – 25r

(1 – 0.75)Y = 425 – 25r

Y = (1/0.25) (425 – 25r)

Y = 1,700 – 100r.

(b)The LM curve is determined by equating the demand for real money balance and supply of real money balances. The supply of real balances is 1,000/2 = 500. Setting this equal to money demand, we find:

500 = Y – 100r.

Y = 500 + 100r.

(c) If we take the price level as given, then the IS and the LM equations give us two equations in two unknowns, Y and r. We found the following equations in parts (a) and (b):

IS: Y = 1,700 – 100r.

LM: Y = 500 + 100r.

Equating these, we can solve for r:

1,700 – 100r = 500 + 100r

1,200 = 200r

r = 6.

Now that we know r, we can solve for Y by substituting it into either the IS or the LM equation. We find Y = 1,100. Therefore, the equilibrium interest rate is 6 percent and the equilibrium level of output is 1,100

(d) If government purchases increase from 100 to 150, then the IS equation becomes:

Y = 200 + 0.75(Y – 100) + 200 – 25r + 150.

Simplifying, we find:

Y = 1,900 – 100r.

We see that the IS curve shifts to the right by 200. By equating the new IS curve with the LM curve derived in part (b), we can solve for the new equilibrium interest rate:

1,900 – 100r = 500 + 100r

1,400 = 200r

7 = r.

We can now substitute r into either the IS or the LM equation to find the new level of output. We find Y = 1,200. Therefore, the increase in government purchases causes the equilibrium interest rate to rise from 6 percent to 7 percent, while output increases from 1,100 to 1,200.

(e)If the money supply increases from 1,000 to 1,200, then the LM equation becomes:

(1,200/2) = Y – 100r,

or

Y = 600 + 100r.

We see that the LM curve shifts to the right by 100 because of the increase in real money balances. To determine the new equilibrium interest rate and level of output, equate the IS curve from part (a) with the new LM curve derived above:

1,700 – 100r = 600 + 100r

1,100 = 200r

5.5 = r.

Substituting this into either the IS or the LM equation, we find

Y = 1,150.

Therefore, the increase in the money supply causes the interest rate to fall from 6 percent to 5.5 percent, while output increases from 1,100 to 1,150.

(f)If the price level rises from 2 to 4, then real money balances fall from 500 to 1,000/4 = 250. The LM equation becomes:

Y = 250 + 100r.

the LM curve shifts to the left by 250 because the increase in the price level reduces real money balances. To determine the new equilibrium interest rate, equate the IS curve from part (a) with the new LM curve from above:

1,700 – 100r = 250 + 100r

1,450 = 200r

7.25 = r.

Substituting this interest rate into either the IS or the LM equation, we find Y = 975.

Therefore, the new equilibrium interest rate is 7.25, and the new equilibrium level of output is 975.

(g)The aggregate demand curve is a relationship between the price level and the level of income. To derive the aggregate demand curve, we want to solve the IS and the LM equations for Y as a function of P. That is, we want to substitute out for the interest rate. We can do this by solving the IS and the LM equations for the interest rate:

IS: Y = 1,700 – 100r

100r = 1,700 – Y.

LM: (M/P) = Y – 100r

100r = Y – (M/P).

Combining these two equations, we find

1,700 – Y = Y – (M/P)
2Y = 1,700 + M/P
Y = 850 + M/2P.
Since the nominal money supply M equals 1,000, this becomes
Y = 850 + 500/P.

How does the increase in fiscal policy of part (d) affect the aggregate demand curve? We can see this by deriving the aggregate demand curve using the IS equation from part (d) and the LM curve from part (b):
IS: Y = 1,900 – 100r
100r = 1,900 – Y.
LM: (1,000/P) = Y – 100r
100r = Y – (1,000/P).
Combining and solving for Y:
1,900 – Y = Y – (1,000/P),
or
Y = 950 + 500/P.

By comparing this new aggregate demand equation to the one previously derived, we can see that the increase in government purchases by 50 shifts the aggregate demand curve to the right by 100. How does the increase in the money supply of part (e) affect the aggregate demand curve? Because the AD curve is Y = 850 + M/2P, the increase in the money supply from 1,000 to 1,200 causes it to become
Y = 850 + 600/P.

By comparing this new aggregate demand curve to the one originally derived, we see that the increase in the money supply shifts the aggregate demand curve to the right.

Question 4 on page 351

(a)The invention of the new high-speed chip increases investment demand, meaning that at every interest rate, firms want to invest more. The increase in the demand for investment goods shifts the IS curve out and to the right, raising income and employment. The increase in income from the higher investment demand also raises interest rates. This happens because the higher income raises demand for money; since the supply of money does not change, the interest rate must rise in order to restore equilibrium in the money market. The rise in interest rates partially offsets the increase in investment demand, so that output does not rise by the full amount of the rightward shift in the IS curve. Overall, income, interest rates, consumption, and investment all rise. If the Federal Reserve wants to keep output constant, then it must decrease the money supply and increase interest rates further in order to offset the effect of the increase in investment demand. When the Fed decreases the money supply, the LM curve will shift up and to the left. Output will remain at the same level and the interest rate will be higher. There will be no change in consumption and no change in investment. the interest rate will increase by enough to completely offset the initial increase in investment demand.

(b). The increased demand for cash shifts the LM curve up. This happens because at any given level of income and money supply, the interest rate necessary to equilibrate the money market is higher. .The upward shift in the LM curve lowers income and raises the interest rate. Consumption falls because income falls, and investment falls because the interest rate rises due to the increase in money demand. If the Federal Reserve wants to keep output constant, then they must increase the money supply in order to lower the interest rate and bring output back to its original level. The LM curve will shift down and to the right and return to its old position. In this case, nothing will change.

(c). At any given level of income, consumers now wish to save more and consume less. Because of this downward shift in the consumption function, the IS curve shifts inward. Income, interest rates, and consumption all fall, while investment rises. Income falls because at every level of the interest rate, planned expenditure falls. The interest rate falls because the fall in income reduces demand for money; since the supply of money is unchanged, the interest rate must fall to restore money-market equilibrium. Consumption falls both because of the shift in the consumption function and because income falls. Investment rises because of the lower interest rates and partially offsets the effect on output of the fall in consumption. If the Federal Reserve wants to keep output constant, then they must increase the money supply in order to reduce the interest rate and increase output back to its original level. The increase in the money supply will shift the LM curve down and to the right. Output will remain at its original level, consumption will be lower, investment will be higher, and interest rates will be lower.

(d) First remember that the real cost of capital is

$$\text{cost of capital} = P_k(i + \delta - \pi)$$

where i is the nominal interest rate δ is the depreciation rate and π is the inflation rate. This implies that a higher inflation rate will lower the cost of capital and stimulate the investment. On the other hand, the higher deflation rate will make the cost of capita higher and makes the amount of investment lower. This implies that when the deflation rate becomes high, the investment becomes lower even if the nominal interest stays constant.

This means that IS curve will shift to the left. (See 12-8 on the text). Thus, the equilibrium GDP becomes lower and the equilibrium interest rate becomes lower.

Question 8 on page 351.

(a) Note that we have the following equations

$$\begin{aligned} C &= a + b(Y - T) \\ I &= c - dr \\ Y &= C + I + G \end{aligned}$$

Then, by combing those three equations, we have

$$\begin{aligned} Y &= a + bY - bT + c - dr + G \\ (1-b)Y &= a - bT + c - dr + G \\ Y &= \frac{a}{1-b} - \frac{b}{1-b}T + \frac{c}{1-b} - \frac{d}{1-b}r + \frac{1}{1-b}G \end{aligned}$$

(b) For deriving IS curve it is useful to solve for r since we put r on the vertical axis on the IS-LM. Thus, we have

$$\begin{aligned} \frac{d}{1-b}r &= -Y + \frac{a}{1-b} - \frac{b}{1-b}T + \frac{c}{1-b} + \frac{1}{1-b}G \\ dr &= -(1-b)Y + a - bT + c + G \\ r &= \frac{-(1-b)}{d}Y + \frac{a}{d} - \frac{b}{d}T + \frac{c}{d} + \frac{1}{d}G \end{aligned}$$

Thus, as d becomes larger the IS curve flatter. When d is large, the amount of investment is very sensitive to a change of interest rate. Thus, when the interest rate increases, the amount of investment decreases a lot. In keynesian cross, this implies that GDP goes down a lot. Thus, when d is large, as interest increases, Y goes down a lot. Thus, IS curve becomes flat.

(c) When the government increases the government expenditure by $1, IS curve will shift by 1/(1-mpc). On the other hand, when the government cut the tax by one dollar, the GDP increases mPC/(1-mpc).Thus, increasing the government expenditure is more effective.

(d)Demand for real money balance is L=eY-fr. At the equilibrium, Demand for real money balance should be equal to M/P. Thus, we have

$$M/P = eY - fr$$

Solving for r, we have

$$fr = ey - \frac{M}{p}$$

$$r = \frac{e}{f}r - \frac{1}{f}\frac{M}{P}$$

The slope of LM curve is e/f

(e) parameter f shows how the demand for real money balance is sensitive to the interest rate. When f is large, then even for a small change of the interest rate, the demand for real money balance will decrease. Now assume that f is large and suppose that Y increase. This implies that the demand for real money balance will increase. In order to archive the equilibrium in the money market, the interest rate must increase. On the other hand, when f is large, even a small tiny increase of the interest is sufficient to archive the equilibrium in the money

market again. This implies that LM curve becomes very flat when f is quite large. On the other hand, when f is very small, and Y increase, a huge increase of the interest rate is needed to achieve the equilibrium in the money market again. This implies that when f is small, the LM curve becomes very vertical.

(f) When M increase LM curve will shift let. This can be seen from the above equation

$$r = \frac{e}{f}Y - \frac{1}{f}\frac{M}{P}$$

Thus, as f becomes smaller, the shift of the LM curve becomes bigger.

(i) The shift of LM curve does not depend on e

(ii) The shift of LM curve depend on f. As f becomes larger, the shift becomes smaller. Intuitively, when f is small, the demand for real money balance does not depend on the interest rate so much. So suppose that the central bank increases money supply and income stays constant. This implies that to achieve the equilibrium, the interest rate must go down. However, if the demand for real money balance is not much sensitive with respect to the interest rate, then the interest rate must decrease a lot. Thus, LM curve will shfit a lot.

(g) Note that as IS curve, we have

$$\begin{aligned} r &= \frac{-(1-b)}{d}Y + \frac{a}{d} - \frac{b}{d}T + \frac{c}{d} + \frac{1}{d}G \\ r &= \frac{e}{f}Y - \frac{1}{f}\frac{M}{P} \end{aligned}$$

Thus, solve for Y we have

$$\begin{aligned} \frac{e}{f}Y - \frac{1}{f}\frac{M}{P} &= \frac{-(1-b)}{d}Y + \frac{a}{d} - \frac{b}{d}T + \frac{c}{d} + \frac{1}{d}G \\ \{\frac{e}{f} + \frac{1-b}{d}\}Y &= \frac{a}{d} - \frac{b}{d}T + \frac{c}{d} + \frac{1}{d}G + \frac{1}{f}\frac{M}{P} \\ Y &= \frac{1}{\{\frac{e}{f} + \frac{1-b}{d}\}}\{\frac{a}{d} - \frac{b}{d}T + \frac{c}{d} + \frac{1}{d}G + \frac{1}{f}\frac{M}{P}\} \\ Y &= \frac{1}{\{\frac{e}{f} + \frac{1-b}{d}\}}\{\frac{a}{d} - \frac{b}{d}T + \frac{c}{d} + \frac{1}{d}G\} \\ &\quad + \frac{f}{\{\frac{e}{f} + \frac{1-b}{d}\}}\frac{M}{P} \end{aligned}$$

(h)Thus, GDP is a negative function of P. As P becomes higher, GDP will decrease.

(i) As you can see from the above equation, an increase in G will increase Y. An increase in T will decrease Y. An increase in M will increase Y.

Question 9 on page 352.

I explain about the answer on this question in the last class. Please see your lecture note.