Exam #2 will cover all the material we have covered since Exam #1. This includes the material we covered in Chapters 10, 11, 12, and 14. In addition to working these problems, I would recommend reviewing all of your old class notes and quizzes, the answers to which are posted on our webpage.

1.) Recall the quantity theory of money. Suppose the Fed reduces the money supply and assume the velocity of money is constant. What happens to the AD curve? What is the intuition?

   If Fed changes the money supply, then possible combos of P & Y change…which means AD shifts. The equation MV = PY tells us that if the money supply is decreased (holding V constant), then there must be a proportionate decrease in PY in order to retain the equilibrium condition. That is, AD shifts inward.

2.) The following equation describes our IS model. Describe the variables r, T, Y, and G as either exogenous or endogenous.

   \[ Y = C(Y-T) + I(r) + G. \]

   Endogenous: Y and r
   Exogenous: T and G

3.) According to the IS-LM model, what happens in the SR to the interest rate, income, consumption, and investment under the following circumstances? Be sure your answer includes an appropriate graph.

   a.) The central bank increases the money supply.

   If the central bank increases the money supply, then the LM curve shifts downward, as shown in Figure 11–4. 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.

   ![Figure 11–4](image-url)
b.) The government increases government purchases.

If government purchases increase, then the government-purchases multiplier tells us that the IS curve shifts to the right by an amount equal to \( \frac{1}{1 - MPC} \Delta G \). This is shown in Figure 11–5. 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.

![Figure 11–5](image)

\[ IS_1 \rightarrow IS_2 \]

Income, output

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c.) The government increases taxes.

If the government increases taxes, then the tax multiplier tells us that the IS curve shifts to the left by an amount equal to \( -\frac{MPC}{1 - MPC} \Delta T \). This is shown in Figure 11–6. 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.

![Figure 11–6](image)

\[ IS_1 \rightarrow IS_2 \]

Income, output
d.) The government increases government purchases and taxes by equal amounts.

We can figure out how much the IS curve shifts in response to an equal increase in government purchases and taxes by adding together the two multiplier effects that we used in parts (b) and (c):

\[ \Delta Y = \left[ \frac{1}{MPC} \right] \Delta G - \left[ \frac{MPC}{1 - MPC} \right] \Delta T \]

Because government purchases and taxes increase by the same amount, we know that \( \Delta G = \Delta T \). Therefore, we can rewrite the above equation as:

\[ \Delta Y = \left[ \frac{1}{MPC} \right] \Delta G - \left[ \frac{MPC}{1 - MPC} \right] \Delta G \]

\[ \Delta Y = \Delta G. \]

This expression tells us how output changes, holding the interest rate constant. It says that an equal increase in government purchases and taxes shifts the IS curve to the right by the amount that \( G \) increases.

This shift is shown in Figure 11-7. Output increases, but by less than the amount that \( G \) and \( T \) increase; this means that disposable income \( Y - T \) falls. As a result, consumption also falls. The interest rate rises, causing investment to fall.

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4.) Use the IS-LM model to predict the SR effects of each of the following shocks on income, the interest rate, consumption, and investment. In each case, explain what the Fed should do to keep income at its initial level.

a.) After the invention of a new high-speed computer chip, many firms decide to upgrade their computer systems.

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 Fed 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.) A best-seller titled *Retire Rich* convinces the public to increase the percentage of their income devoted to saving. 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. Figure 11–10 shows the effect of this IS shift graphically.

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.
5.) Determine whether each of the following statements is true or false, and explain why. For each statement, discuss the impact of monetary and fiscal policy in that special case.

a.) If investment does not depend on the interest rate, the LM curve is horizontal.

False. The IS curve represents the relationship between the interest rate and the level of income that arises from equilibrium in the market for goods and services. If investment does not depend on the interest rate, then NOTHING in the IS equation depends on the interest rate; income must adjust to ensure that the quantity of goods produced, \( Y \), equals the quantity of goods demanded, \( C+I+G \). Thus, the IS curve is vertical.

Monetary policy has no effect on output, because the IS curve determines \( Y \). Monetary policy can affect only the interest rate. In contrast, fiscal policy is effective: output increases by the full amount the IS curve shifts.

b.) If money demand does not depend on income, the LM curve is horizontal.

True. If money demand does not depend on income, then we write the LM equation as

\[
\frac{M}{P} = L(r)
\]

For any given level of real balances \( \frac{M}{P} \), there is only one level of the interest rate at which the money market is in equilibrium. Hence, the LM curve is horizontal.

Fiscal policy is very effective: Output increases by the full amount that the IS curve shifts. Monetary policy is also effective: an increase in the money supply causes the interest rate to fall, so the LM curve shifts down.

6.) Monetary policy and fiscal policy often change at the same time. Suppose the government wants to raise investment but keep output constant. In the IS-LM model, what mix of monetary and fiscal policy will achieve this goal?

To raise investment while keeping output constant, the government should adopt a loose monetary policy and a tight fiscal policy, as shown in Figure 11–20. In the new equilibrium at point B, the interest rate is lower, so that investment is higher. The tight fiscal policy—reducing government purchases, for example—offsets the effect of this increase in investment on output.
7.) Suppose that the demand for real money balances depends on disposable income. That is, the money demand function is
\[ M/P = L(r, Y-T). \]
Using the IS-LM model, discuss whether this change in the money demand function alters the following.

a.) The analysis of changes in government purchases.
The analysis of G is unaffected by making money demand depend on disposable income instead of total expenditure. An increase in G shifts the IS curve to the right, as in the standard case. The LM curve is unaffected by this increase. Thus, the analysis is the same as it was before.

b.) The analysis of changes in taxes.
A tax cut causes disposable income Y-T to increase at every level of income Y. This increases consumption for any given level of income as well, so the IS curve shifts to the right, as in the standard case. If money demand depends on disposable income, however, then the tax cut increases money demand, so the LM curve shifts upward.

Thus, the analysis of a change in taxes is altered drastically by making money demand dependent on disposable income. It is actually possible for a tax cut to be contractionary depending on the relative magnitudes of the IS and LM shifts.

8.) Movement along the LM curve vs. shifts in the LM curve
If changed, which variable(s) result in movement along the LM curve. If changed, which variable(s) result in shifts in the LM curve. (For practice, go through your answers graphically).

A change in income results in movement along the LM curve.
A change in the money supply or the price level will shift the LM curve.

9.) Sticky-price model
In the sticky-price model, describe the aggregate supply curve in the following special cases.

In sticky-price model, all firms have a desired price \( p \) that depends on the overall level of prices \( P \) as well as the level of aggregate demand \( Y - \bar{Y} \). We wrote this as
\[ p = P + a(Y - \bar{Y}). \]

There are two types of firms. A proportion \((1 - s)\) of the firms have flexible prices and set prices using the above equation. The remaining proportion \( s \) of the firms have sticky prices – they announce their prices in advance based on the economic conditions that they expect in the future. We assume that these firms expect output to be at its natural rate, so \((EY - \bar{Y}) = 0\). Hence, these firms set their prices equal to the expected price level:
\[ p = EP. \]

The overall price level is a weighted average of the prices set by the two types of firms:
\( P = sEP + (1-s)[P + a(Y - \bar{Y})]. \)

Rearranging:

\[ P = EP + [a(1-s)/s](Y - \bar{Y}). \]

a.) All firms have sticky prices (i.e., \( s = 1 \))

If no firms have flexible prices, then \( s = 1 \). The above equation tells us that

\[ P = EP. \]

That is, the aggregate price level is fixed at the expected price level: the aggregate supply curve is horizontal in the short run.

b.) The desired price does not depend on aggregate output (i.e., \( a = 0 \))

If desired relative prices do not depend at all on the level of output, then \( a = 0 \) in the equation for the price level. Once again, we find \( P = EP \): the aggregate supply curve is horizontal in the short run.