Problem 5

Part a. The IS curve shows the relationship between output in the goods and foreign exchange market and the nominal interest rate i. Because in equilibrium supply must equal demand, we can use $Y = C + I + G + CA$ and the numbers given to write

$$\begin{aligned} Y &= C + I + G + CA \\ &= [50 + 0.75(Y - 1000)] + [1600 - 250i] + 1200 + [-260 - 0.2Y - 100i]. \end{aligned}$$

This can be simplified (and rounded) to the IS curve,

$$i = 5.26 - 0.001286Y$$

Part b. The LM curve shows the relationship between output in the money market and the nominal interest rate i. This is pretty easy because we just use

$$\frac{M}{\overline{P}} = L(i)Y.$$

If there's an increase in Y, and the central bank does not adjust M, then it has to be the case that $L(i)$ falls. This can only happen if i increases (because a higher interest rate implies less demand for money). Ergo Y and i move in the same direction.

To make things nicer mathematically, we will write money demand as $L(i, Y)$, in this case, $L(i, Y) = 0.5Y - 500i$. Then we get the LM curve,

$$\frac{1000}{0.5} = 0.5Y - 500i \quad \Longrightarrow \quad i = 0.001Y - 4$$

Part c. Looking at the consumption function $C = 50 + 0.75(Y - 1000)$, it is clear that an increase in Y of one unit will give an increase in C of 0.75 units. Therefore $MPC = 0.75$. Right away then we can conclude that $MPS = 0.25$.

Okay, now MPC can be broken down into two components: a change in consumption of home-produced goods and a change in consumption of foreign-produced goods. The current account is best thought of as the trade balance here; so when there's an increase in Y of one unit, imports increase by 0.2 units, and therefore $MPC_F = 0.2$. Hence the remainder must be $MPC_H = 0.55$.

Part d. We have two equations and two unknowns,

$$i = 5.26 - 0.001286Y$$

$$i = 0.001Y - 4.$$

Equating the two through i, we find $Y^* = 4050.74$. Note that there's some rounding going on here; if we avoid rounding altogether, we'll get $Y = 4050$, so let's go with that.

Anyway, plugging Y back into either equation for i, you find $i^* = 0.05$.

Part e. Just take the values for i^* and Y^* and shove them into the equations we're given.

$$\begin{aligned} C &= 50 + 0.75(4050 - 1000) &&= 2337.5, \\ I &= 1600 - 250(0.05) &&= 1587.5, \\ CA &= -260 - 0.2(4050) - 100(0.05) &&= -1075. \end{aligned}$$

Part f. Private saving is defined to be $S_P \equiv Y - T - C$, that is, whatever disposable income households do not spend. Public saving is defined to be $S_G \equiv T - G$, that is, whatever government-raised resources are not spent. The sum of the two yields national saving, $S \equiv Y - C - G$. Plugging things in gives

$$\begin{aligned} S &= 4050 - 2337.5 - 1200 = 512.5, \\ S_P &= 4050 - 1000 - 2337.5 = 712.5, \\ S_G &= 1000 - 1200 &&= -200. \end{aligned}$$

We already know from the previous part that $CA < 0$, but we can also show it by using the fact that $S - I = CA$, which sure enough also gives

$$CA = 512.5 - 1587.5 = -1075.$$

Part g. The exchange rate can found using UIP, which states that

$$i = i^* + \left(\frac{E^e_{h/f}}{E_{h/f}} - 1 \right) \quad \Longrightarrow \quad 0.05 = 0.05 + \left(\frac{4}{E_{h/f}} - 1 \right) \quad \Longrightarrow \quad E_{h/f} = 4.$$

Part h. Oy. Alright, so now the goods market gives

$$\begin{aligned} Y &= [50 + 0.75(Y - 1000)] + [1600 - 250i] + 1400 + [-260 - 0.2Y - 100i] \\ \Longrightarrow \quad i &= 5.83 - 0.001286Y, \end{aligned}$$

the money market is unchanged, so the LM curve is still

$$i = 0.001Y - 4,$$

and equating them gives $Y^* = 4300$ and $i^* = 0.30\%$.

Once again, take the new values for i^* and Y^* and shove them into the equations we're given.

$$\begin{aligned} C &= 50 + 0.75(4300 - 1000) &&= 2525, \\ I &= 1600 - 250(0.30) &&= 1525, \\ CA &= -260 - 0.2(4300) - 100(0.30) &&= -1150. \end{aligned}$$

Repeat the process with the savings definitions to get

$$\begin{aligned} S &= 4300 - 2525 - 1400 = 375, \\ S_P &= 4300 - 1000 - 2525 = 775, \\ S_G &= 1000 - 1400 &&= -400. \end{aligned}$$

Okay, so the government spends more without raising more taxes. This increases consumption; lowers investment; and sends the current account further into a deficit.

Finally, the new exchange rate is

$$i = i^* + \left(\frac{E^e_{h/f}}{E_{h/f}} - 1\right) \quad \Longrightarrow \quad 0.30 = 0.05 + \left(\frac{4}{E_{h/f}} - 1\right) \quad \Longrightarrow \quad E_{h/f} = 3.2$$

Okay, so Y and i have both increased, whereas I, E, and CA have all fallen.

Part i. First set up all four markets in equilibrium.

- The top graph should be $D = C + I + G + CA$ and the 45° line. The intersection gives you the level of output where supply Y equals demand D. Call that Y_1.
- The bottom-center graph should have the downward-sloping IS curve and upward-sloping LM curve intersecting at Y_1 and some equilibrium interest rate, call it i_1.
- The bottom-left graph is the money market graph. Money demand $L(i, Y)$ should intersect MS_1 at i_1, so trace i_1 over from the IS-LM graph.
- The bottom-right graph is the foreign return graph. So draw the downward-sloping FR curve. The equilibrium exchange rate E_1 occurs where i_1 intersects FR, so trace i_1 over from the IS-LM graph again.

Now we're going to increase G.

- Shift the D curve up by ΔG because $D = C + I + G \uparrow + CA$. Now it intersects the 45° line at a higher level of output. (This is the lighter gray line in the Canvas solution.)
- Because Y has increased, so has the demand for money balances, so $L(i, Y)$ shifts to the right. This causes the interest rate to increase and the exchange rate to fall.

- But wait... when the interest rate increases, investment falls; and when the exchange rate decreases, exports will fall and imports will increase, so CA will fall... and therefore D shifts back down *partially.* (This is the blue line in the Canvas solution.) This is the **crowding out** effect; we assume partial crowding out, which is why D doesn't fall all the way back down to its initial position.

  So there is still overall an upward shift in D. This gives us higher Y_2, higher i_2, and lower E_2 in equilibrium. This manifests as a **rightward shift of the IS curve**.
- The initial shock was an upward movement of demand for goods and services, so IS shifts to the right; but there is no change to LM because neither the money supply nor L change (only the arguments of $L(i, Y)$ change, i.e. i and Y, but not the function L itself).

These results are all consistent with the numerical example: Y and i have both increased, whereas I, E, and CA have all fallen.

Problem 6

Part a. Just explained it at the end of the previous problem.

Part b. When consumer confidence decreases, consumption decreases. Thus the shock is $C \downarrow$.

- Shift the D curve down by ΔC because $D = C \downarrow + I + G + CA$. Now it intersects the 45° line at a lower level of output. (This is the lighter gray line in the Canvas solution.)
- Because Y has decreased, so has the demand for money balances, so $L(i, Y)$ shifts to the left. This causes the interest rate to decrease and the exchange rate to increase.
- But wait... when the interest rate decreases, investment increases; and when the exchange rate increases, exports will increase and imports will decrease, so CA will increase... and therefore D shifts back up *partially.* (This is the blue line in the Canvas solution.)

  There is still overall a downward shift in D, however. This gives us lower Y_2, lower i_2, and higher E_2 in equilibrium. This manifests as a **leftward shift of the IS curve**.
- The initial shock was a downward movement of demand for goods and services, so IS shifts to the left; but there is no change to LM because the initial shock was not to the money market.

In conclusion: Y falls, i falls, E increases, C falls, I increases, CA increases.

Part c. Since prices are fixed in the short run, the increase in the money supply shifts MS to the right.

- An increase in the money supply causes i to fall (this is the lighter gray line in the Canvas solution) and E to increase.
- This in turn causes investment to increase and the CA to increase. This implies an upward shift in demand, which implies higher Y.
- But wait... when output increases, the money demand function shifts to the right. This causes the interest rate to move back up *partially* (this is the blue line in the Canvas solution), which in turn means investment will go back down *partially*, the exchange rate will go back down *partially*, and the current account will go back down *partially*.

  Overall we still have a lower interest rate i_2, a higher exchange rate E_2, higher demand D_2, and higher output Y_2. This manifests as a **rightward shift of the LM curve**.
- The initial shock was a change in money supply, so that means LM will shift to the right but IS does not shift at all. The new intersection will be at Y_2 and i_2.

In conclusion: Y increases, i decreases, E increases, C increases, I increases, CA increases.

Part d. When foreign output increases, there will be an increased foreign demand for home goods. This means EX increases and therefore CA increases. This is the initial shock.

- Shift the D curve up because $D = C + I + G + CA \uparrow$. Now it intersects the 45° line at a higher level of output. (This is the lighter gray line in the Canvas solution.)
- Because Y has increased, so has the demand for money balances, so $L(i, Y)$ shifts to the right. This causes the interest rate to increase and the exchange rate to fall.
- But wait... when the interest rate increases, investment falls; and when the exchange rate decreases, exports will fall, so CA will fall... and therefore D shifts back down *partially.* (This is the blue line in the Canvas solution.)

  There is still overall an upward shift in D, however. This gives us higher Y_2, higher i_2, and lower E_2 in equilibrium. This manifests as a **rightward shift of the IS curve**.
- The initial shock was an upward movement of demand for goods and services, so IS shifts to the right; but there is no change to LM because the initial shock was not to the money market.

In conclusion: Y increases, i increases, E falls, C increases, I decreases.

The effect on CA is more complicated, though. There is downward pressure on CA because E falls. But there is upward pressure on CA because foreign demand for exports has increased. The overall effect is therefore ambiguous.

Part e. Expected depreciation means $E^e_{h/f}$ increases.

- Shift the FR curve up because because remember, it is given by UIP:

$$FR = i^* + \left(\frac{E^e_{h/f}}{E_{h/f}} - 1 \right).$$

- This implies a higher exchange rate today. Since home currency has depreciated, home goods are cheaper, so exports increase and CA increases. Therefore demand shifts upwards (this is the lighter gray line in the Canvas solution), which implies an increase in Y.
- Because Y has increased, so has the demand for money balances, so $L(i, Y)$ shifts to the right. This causes the interest rate to increase and the exchange rate to fall.
- But wait... when the interest rate increases, investment falls; and when the exchange rate decreases, exports will fall and imports will increase, so CA will fall... and therefore D shifts back down *partially.* (This is the blue line in the Canvas solution.)

  There is still overall an upward shift in D, however. This gives us higher Y_2, higher i_2, and higher E_2 in equilibrium. This manifests as a **rightward shift of the IS curve**.
- The initial shock was (essentially) an upward shift in demand for goods and services, so IS shifts to the right; but there is no change to LM because the initial shock was not to the money market.

In conclusion: Y increases, i increases, E increases, C increases, I decreases, and CA increases.

Part f. If the government raises taxes, then C falls. Part (b) then repeats itself. Hooray.

Problem 7

Part a. We're going to increase G. The exchange rate is fixed.

- The increase in G **shifts the IS curve to the right**. This implies higher output Y_2 and higher interest rate i_2.
- The higher interest rate implies a lower exchange rate E_2 in the FX market.
- But wait... the exchange rate is supposed to be fixed at E_1. The central bank gets back to the original exchange rate by getting back to the original interest rate. They do this by increasing the money supply, which lowers the interest rate back to i_1. This can be seen as **shifting the LM curve to the right**.

In conclusion: Y increases, i is unchanged, E is unchanged, C increases, I is unchanged, and CA is unchanged.

Part b. Consumer confidence implies a fall in C.

- The decrease in C **shifts the IS curve to the left**. This implies lower output Y_2 and lower interest rate i_2.
- The lower interest rate implies a higher exchange rate E_2 in the FX market.
- But wait... the exchange rate is supposed to be fixed at E_1. The central bank gets back to the original exchange rate by getting back to the original interest rate. They do this by decreasing the money supply, which raises the interest rate back to i_1. This can be seen as **shifting the LM curve to the left**.

In conclusion: Y decreases, i is unchanged, E is unchanged, C decreases, I is unchanged, and CA is unchanged.

Part c. The money supply increases and since prices are fixed, we move MS to the right.

- The increase in the money supply **shifts the LM curve to the right**.
- The shift implies a lower interest rate i_2 and therefore a higher exchange rate E_2.
- But wait... the central bank dislikes the higher exchange rate, so they reduce the money supply. This **shifts LM back to the ~~future~~ left** and the interest rate goes right back up to i_1, the exchange rate back to E_1.

In conclusion: nothing ultimately changes. Incroyable.

Part d. When foreign output increases, there will be an increased foreign demand for home goods. This means EX increases and therefore CA increases. This is the initial shock.

- The increase in CA **shifts the IS curve to the right**. There's a higher interest rate, i_2.
- The higher interest rate implies a lower exchange rate E_2.
- But wait... the central bank dislikes the lower exchange rate. They increase the money supply, which **shifts the LM curve to the right**, thereby lowering the interest rate so that the exchange rate goes back to E_1.

In conclusion: Y increases, i is unchanged, E is unchanged, C increases, I is unchanged, CA increases.

Part e. Expected depreciation means $E^e_{h/f}$ increases.

- The FR curve shifts to the right, so the exchange rate increases.
- The increase in the exchange rate causes CA to increase, so **IS shifts to the right**. Now there's a higher interest rate i_2 and a higher exchange rate E_2.

- But wait... the central bank dislikes the higher exchange rate. They can reduce the exchange rate by reducing the money supply, which **shifts the LM curve to the left** and increases the interest rate to i_3, thereby reducing the exchange rate back to E_1.

Important Graphing Tip!!!111: For this question, it is very important that you *draw the magnitudes of the shifts correctly*. Because there is a fixed exchange rate, we will end up with the same E, but higher i. The higher i means that investment will have fallen; so the final answer should see an overall reduction in Y relative to Y_1. This can be accomplished with a relatively **small shift in IS**, which must then be accompanied by a relatively **large shift in LM**.

In conclusion: Y decreases, i increases, E is unchanged, C decreases, I decreases, and CA is unchanged.

Part f. If the government raises taxes, then C falls. Part (b) then repeats itself. Hooray.

Problem 8

The increase in money demand means the L function shifts to the right, even for the same i and Y.

Part a. Monetary policy response under a floating exchange rate regime.

- When L shifts to the right, the interest rate increases to i_2 and therefore the exchange rate falls to E_2. This means Y falls to Y_2. The joint increase in i and decrease in Y can be seen as a **leftward shift of the LM curve**.
- The central bank wants output to stabilize at the old level Y_1, so they cut the money supply, which **shifts the LM curve to the right**, back to its original position. Then we are indeed back to i_1 and Y_1.

In conclusion: the money supply is larger but everything else is the same.

Part b. Fiscal policy response under a floating exchange rate regime.

- When L shifts to the right, the interest rate increases to i_2 and therefore the exchange rate falls to E_2. This means Y falls to Y_2. The joint increase in i and decrease in Y can be seen as a **leftward shift of the LM curve**.
- The fiscal authority wants output to stabilize at the old level Y_1, so they increase G or cut T, which **shifts the IS curve to the right**. Then we are indeed back to Y_2, but now i is even higher at i_3 and the exchange rate is even lower at E_3. (This also shifts $L(i, Y)$ higher since Y just went up.)

In conclusion: Y is unchanged, i is higher, E is smaller, I is smaller, CA is smaller, C could is higher if T was reduced.

Part c. Monetary policy response under a fixed exchange rate regime. The mechanics will be the exact same as in part a, since the increase in the money supply returns both Y and E back to their original levels.

Part d. Fiscal policy response (or lack thereof) under a fixed exchange rate regime. The mechanics will be the exact same as in part a — the fact that the exchange rate falls means the central bank will immediately increase the money supply to get the exchange rate back to its original level. This also just so happens to get Y back to its original level, so fiscal stabilization policy response is unnecessary.

Part e. Since the central bank responds immediately, i and E go back to their original levels. Furthermore, there is no change in E^e because investors expected E go back to its original level. Therefore the FR curve is unaffected and UIP still holds.

Part f. Kinda just answered that. But since Y and E and i are all unaffected, the CA is unchanged as well.

Part g. From part b we know that there will be higher i and lower E after fiscal response. Higher i increases the payoff of domestic return. Foreign return is a little trickier; we are told that investors *expect* the fiscal response, and therefore *expect* lower E so that $E^e = E$; and therefore the fraction E^e/E remains the same. This means that foreign return

$$FR \equiv i^* + \left(\frac{E^e_{h/f}}{E_{h/f}} - 1 \right)$$

is unchanged in the short run unless the foreign central bank responds. Therefore the domestic return is now relatively more attractive — UIP fails for the time being — so funds will flow into home deposits.