Total: 15 points

1 (4 points, 1 point for (a) and 0.5 point for each effect). a. If the Fed reduces the money supply, then the aggregate demand curve shifts down. This result is based on the quantity equation $MV = PY$, which tells us that a decrease in money $M$ leads to a proportionate decrease in nominal output $PY$ (assuming that velocity $V$ is fixed). For any given price level $P$, the level of output $Y$ is lower, and for any given $Y$, $P$ is lower.

b. In the short run, we assume that the price level is fixed and that the aggregate supply curve is flat. In the short run, the leftward shift in the aggregate demand curve leads to a movement such that output falls but the price level doesn’t change. In the long run, prices are flexible. As prices fall, the economy returns to full employment.

If we assume that velocity is constant, we can quantify the effect of the 5-percent reduction in the money supply. Recall from Chapter 4 that we can express the quantity equation in terms of percentage changes:

$$
\% \Delta \text{ in } M + \% \Delta \text{ in } V = \% \Delta \text{ in } P + \% \Delta \text{ in } Y.
$$

If we assume that velocity is constant, then the $\% \Delta \text{ in } V = 0$. Therefore,

$$
\% \Delta \text{ in } M = \% \Delta \text{ in } P + \% \Delta \text{ in } Y.
$$

We know that in the short run, the price level is fixed. This implies that the $\% \Delta \text{ in } P = 0$. Therefore,

$$
\% \Delta \text{ in } M = \% \Delta \text{ in } Y.
$$

Based on this equation, we conclude that in the short run a 5-percent reduction in the money supply leads to a 5-percent reduction in output.

In the long run we know that prices are flexible and the economy returns to its natural rate of output. This implies that in the long run, the $\% \Delta \text{ in } Y = 0$.

Therefore,

$$
\% \Delta \text{ in } M = \% \Delta \text{ in } P.
$$
Based on this equation, we conclude that in the long run a 5-percent reduction in the money supply leads to a 5-percent reduction in the price level.

c. Okun’s law refers to the negative relationship that exists between unemployment and real GDP. Okun’s law can be summarized by the equation:

\[ \% \Delta \text{ in Real GDP} = 3\% - 2 \times [\Delta \text{ in Unemployment Rate}] \]

That is, output moves in the opposite direction from unemployment, with a ratio of 2 to 1. In the short run, when output falls, unemployment rises. Quantitatively, if velocity is constant, we found that output falls 5 percentage points relative to full employment in the short run. Okun’s law states that output growth equals the full employment growth rate of 3 percent minus two times the change in the unemployment rate.

Therefore, if output falls 5 percentage points relative to full employment growth, then actual output growth is \(-2\) percent. Using Okun’s law, we find that the change in the unemployment rate equals 2.5 percentage points:

\[
\begin{align*}
-2 &= 3 - 2 \times [\Delta \text{ in Unemployment Rate}] \\
[-2 - 3]/[-2] &= [\Delta \text{ in Unemployment Rate}] \\
2.5 &= [\Delta \text{ in Unemployment Rate}]
\end{align*}
\]

In the long run, both output and unemployment return to their natural rate levels. Thus, there is no long-run change in unemployment.

d. The national income accounts identity tells us that saving \(S = Y - C - G\). Thus, when \(Y\) falls, \(S\) falls (assuming the marginal propensity to consume is less than one). This causes the real interest rate to rise. When \(Y\) returns to its original equilibrium level, so does the real interest rate.

2. (4 points, 1 point for each policy option) a. An exogenous decrease in the velocity of money causes the aggregate demand curve to shift downward. In the short run, prices are fixed, so output falls.

If the Fed wants to keep output and employment at their natural-rate levels, it must increase aggregate demand to offset the decrease in velocity. By increasing the money supply, the Fed can shift the aggregate demand curve upward, restoring the economy to its original equilibrium. Both the price level and output remain constant.

If the Fed wants to keep prices stable, then it wants to avoid the long-run adjustment to a lower price level. Therefore, it should increase the money
supply and shift the aggregate demand curve upward, again restoring the original equilibrium.

Thus, both Feds make the same choice of policy in response to this demand shock.

b. An exogenous increase in the price of oil is an adverse supply shock that causes the short-run aggregate supply curve to shift upward. If the Fed cares about keeping output and employment at their natural-rate levels, then it should increase aggregate demand by increasing the money supply. This policy response shifts the aggregate demand curve upwards. In this case, the economy immediately reaches a new equilibrium. The price level at the new equilibrium is permanently higher, but there is no loss in output associated with the adverse supply shock.

If the Fed cares about keeping prices stable, then there is no policy response it can implement. In the short run, the price level stays at the higher level. If the Fed increases aggregate demand, then the economy ends up with a permanently higher price level. Hence, the Fed must simply wait, holding aggregate demand constant. Eventually, prices fall to restore full employment at the old price level. But the cost of this process is a prolonged recession.

Thus, the two Feds make a different policy choice in response to a supply shock.

3. (3 points) a. Total planned expenditure is

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

Plugging in the consumption function and the values for investment I, government purchases G, and taxes T given in the question, total planned expenditure PE is

\[ PE = 200 + 0.75(Y - 100) + 100 + 100 = 0.75Y + 325. \]

b. To find the equilibrium level of income, combine the planned-expenditure equation derived in part (a) with the equilibrium condition \( Y = PE \):

\[ Y = 0.75Y + 325 \]

\[ Y = 1,300. \]

The equilibrium level of income is 1,300.
c. If government purchases increase to 125, then planned expenditure changes to

\[ PE = 0.75Y + 350. \]

Equilibrium income increases to \( Y = 1,400 \). Therefore, an increase in government purchases of 25 (i.e., \( 125 - 100 = 25 \)) increases income by 100. This is what we expect to find, because the formula for the government-purchases multiplier is \( 1/(1 - MPC) \), the MPC is 0.75, and the government-purchases multiplier therefore has a numerical value of 4.

d. An income level of 1,600 represents an increase of 300 over the original level of income. The government-purchases multiplier is \( 1/(1 - MPC) \): the MPC in this example equals 0.75, so the government-purchases multiplier is 4. This means that government purchases must increase by 75 (to a level of 175) for income to increase by 300.

4 (4 points, 1 point for each sub-question). a. If society becomes more thrifty—meaning that for any given level of income people save more and consume less—then the planned-expenditure function shifts downward. Equilibrium income falls.

b. Equilibrium saving remains unchanged. The national accounts identity tells us that saving equals investment, or \( S = I \). In the Keynesian-cross model, we assumed that desired investment is fixed. This assumption implies that investment is the same in the new equilibrium as it was in the old. We can conclude that saving is exactly the same in both equilibria.

c. The paradox of thrift is that even though thriftiness increases, saving is unaffected. Increased thriftiness leads only to a fall in income. For an individual, we usually consider thriftiness a virtue. From the perspective of the entire economy as represented by the Keynesian-cross model, however, thriftiness is a vice.

d. In the classical model of Chapter 3, the paradox of thrift does not arise. In that model, output is fixed by the factors of production and the production technology, and the interest rate adjusts to equilibrate saving and investment, where investment depends on the interest rate. An increase in thriftiness decreases consumption and increases saving for any level of output; since output is fixed, the saving schedule shifts to the right. At the new equilibrium, the interest rate is lower, and investment and saving are higher.