You may work together on the problems, but you should try each question yourself first, and the answers must be written up in your own words. For all questions be sure to explain your answers carefully and to use graphs whenever appropriate.

1. Describe how, if at all, each of the following developments affects the real interest rate and output in the short run (or whether it is not possible to tell). In parts (a) and (b), assume that the central bank is following an interest rate rule; in parts (c) and (d), use the information in the question to decide what assumption to make about how monetary policy is being conducted.
   a. The government cuts taxes.
   b. The government cuts taxes and government purchases by equal amounts.
   c. The government cuts taxes and, at the same time, the central bank changes its monetary policy rule so that it sets a lower real interest rate at a given level of output than before.
   d. The central bank lowers its target for the money stock.

2. Suppose the central bank changes its policy rule to respond more to changes in output. Specifically, it decides not to change the real interest rate at the current level of output, but that it will increase it by more than before if output rises, and cut it by more than before if output falls.
   a. Would you use the IS–MP or IS–LM model to analyze the effects of this development? Why?
   b. How, if at all, would this development affect the two curves (IS and MP, or IS and LM)? Explain your reasoning.
   c. Suppose that after this change in the monetary policy rule, firms become more optimistic about the profitability of investment projects, so investment demand at a given real interest rate is higher than before. How, if at all, does this change affect the real interest rate and output in the short run? For each variable (r and Y), is the effect larger than before the change in the rule, smaller, the same, or is it impossible to tell?

3. Label each of the following statements as True, False, or Uncertain, and explain your answer briefly.
   a. In the short run, an increase in consumer confidence raises the real interest rate, consumption, and real GDP.
   b. The fact that the U.S. output growth was only slightly less volatile in the four decades after World War 2 than in the four decades or so before the Great Depression shows that fiscal and monetary policy do not have large short-run effects on output.
   c. If consumers decide to save more at a given level of disposable income than before, investment will rise, and so output will rise.

4. This problem asks you to compare the recovery from the Great Recession with the recoveries from the three largest postwar recessions before the Great Recession (1957-58, 1973-75, 1981-82). The troughs of these four recessions (as measured by real GDP) occurred

a. Find the average annual growth rate of real GDP in the 8 quarters after the trough of each recession.

b. Find the change in the unemployment rate, in percentage points, over the 8 quarters after the trough of each recession.

c. Repeat the calculations in part (a) for the residential investment part of real GDP.

d. Based on your answers to (a)-(c), would you agree or disagree with the claims that the recovery from the Great Recession has been unusually slow, and that housing has not played its usual role in driving recovery?

(Note: (1) If \( x_0 \) and \( x_t \) are the levels of some variable \( N \) quarters apart, the two ways economists might compute the average annual growth rate of \( x \) over those \( N \) quarters (which will give slightly different answers) are \( 100 \times [\frac{(x_1/x_0)^{4/N}}{N} - 1] \) and \( 400 \times [\frac{\ln(x_1) - \ln(x_0)}{N}] \). You may use either formula. (2) If a series is only available monthly, you can compute quarterly figures by averaging the observations for the 3 months of the quarter.)

Pick the best answer to each of questions 5-8. No explanations of your answers are needed.

5. If the central bank is targeting the money supply, an increase in government purchases:
   a. Shifts the LM curve up.
   b. Shifts the LM curve down.
   c. Does not affect the LM curve.
   d. It is not possible to tell.

6. The IS curve slopes down because:
   a. As the real interest rate rises, the government increases taxes to finance the greater interest payments on its debt.
   b. As the real interest rate rises, the central bank tightens monetary policy.
   c. As the real interest rate rises, the government cuts back on its purchases.
   d. As the real interest rate rises, households invest less in the stock market.
   e. As the real interest rate rises, firms buy fewer machines and build fewer factories.
   f. (a) and (b).
   g. All of the above.

7. Saying that the regression \( y_t = a + bx_t + e_t \) suffers from omitted variable bias means that:
   a. There is correlation between the variables left out of the regression (which show up in \( e \)) and the variable whose effect on \( y \) we are trying to estimate (\( x \)).
   b. The variables left out of the regression (which show up in \( e \)) affect the variable whose behavior we are trying to understand (\( y \)).
   c. The researcher chose to omit some observations because they do not support his or her hypothesis.
   d. \( y \) is on average high when \( x \) is high, and low when \( x \) is low.

8. The following periods are listed in order from least to greatest macroeconomic volatility:
   e. None of the above.