All questions refer to the following specification of the IS/LM model

\[
\text{LM: } \frac{M}{P} = m + l(r + \pi) + dY, \quad l < 0, \quad d > 0
\]

\[
\text{IS: } Y = A + cY + br + G, \quad c > 0, \quad b < 0
\]

\(A, \ G, \ M, \ P, \) and \(\pi\) are exogenous.

1. Suppose that \(M\) is decreased.

   a. Does equilibrium \(Y\) increase or decrease? Interpret.
   b. Does equilibrium \(r\) increase or decrease? Interpret.

   To answer this question, it is necessary to identify how a change in \(M\) shifts the IS and LM curves. The IS curve is not shifted, since the curve does not include the money supply as one of its determinants. The LM curve shifts upwards; the argument for this was shown in class. This shift means the equilibrium level of \(Y\) will decrease and the equilibrium level of \(r\) will increase. Intuitively, a decrease in the money supply raises interest rates as individuals want to hold more money than is available at the original output and interest rate levels and so respond to the decrease by trying to shift out of bonds; lower demand for bonds lowers bond prices and raises interest rates; the increase in interest rates reduces investment and hence output leading to the new equilibrium.

2. Suppose that \(P\) is decreased.

   a. Does equilibrium \(Y\) increase or decrease? Interpret.
   b. Does equilibrium \(r\) increase or decrease? Interpret.

   The answer to this question is similar to 1 except the money supply change is in the opposite direction. A decrease in \(P\) increases the real money supply and induces (qualitatively speaking) the same shift in the LM curve that is associated with an increase in \(M\) when \(P\) is fixed. Hence, the LM curve shifts down.
3. Suppose that this basic model is modified to include taxes of the form \( T = T_0 + tY \)

a. Does the presence of taxes increase or decrease \( Y \)? Explain.
b. Does the presence of taxes increase or decrease \( r \)? Explain.

This question can be answered immediately using the intercept and slope expressions for the IS equation that were computed in lecture 9. The intercept will equal

\[
\frac{cT - A - G - NX}{b}
\]

and the slope will equal

\[
\frac{1 - c(1-t)}{b}
\]

Notice that the income tax term \( t \) means replacing the term \( c \) that appears in the original expressions for the intercept and slope with \( c(1-t) \). Think about why this is so. Therefore, the intercept is reduced and the IS curve slope is made steeper. Each of these changes will reduce \( Y \) and \( r \). Why? Both a lump sum tax and an income tax reduce aggregate demand at each interest rate level. Lower income requires lower interest rates in order to equilbrate the money market.