I. Shorties (25 minutes total)

A. (15 minutes). State whether each of the following is true, false, or uncertain. Provide a brief explanation of your answer. Do all three of the following.

1. In the classical distribution model with productive factors capital and labor, a wave of immigration raises wages and decreases the share of capital in national income.

False. For a standard production function, wages = MPL. With given K, a rise in L lowers real wages. However, the impact on the share of capital is ambiguous and can go either way (it is constant in the Cobb-Douglas production function.)

2. The Baumol-Tobin model of money demand predicts that (other things held constant) a 1 percent increase in real output would lead to a 2 percent increase in the demand for nominal money.

False

The Baumol-Tobin model predicts that demand for money will be reflected in the following equation:

\[
\text{Average Money Holdings} = M^* = \sqrt[2]{\frac{YF}{2i}}
\]

Rewriting the equation, we get that:

\[
M^* = \frac{\sqrt{Y} \cdot \sqrt{F}}{\sqrt{2} \cdot \sqrt{i}} = \frac{Y^{\frac{1}{2}} \cdot F^{\frac{1}{2}}}{2^{\frac{1}{2}} \cdot i^{\frac{1}{2}}}
\]

So, using logarithms, we can look at the changes in \(M^*\) based on changes in \(Y\):

\[
\ln M^* = \frac{1}{2} \ln(Y) + \frac{1}{2} \ln(F) - \frac{1}{2} \ln(2) - \frac{1}{2} \ln(i)
\]

So, a 1% increase in \(Y\) leads to a 0.5% increase in nominal \(M\), for given \(P\).
3. When used to compute the growth rate of real GDP, a Laspeyres index provides a biased estimate.

**True**

*The Laspeyres quantity index uses base year quantities and prices, updating quantities for the new year while using base year prices as weights to arrive at an estimate of real GDP growth. By using the base year prices as weights, it fails to consider consumers’ substitution effects. It gives too much weight to goods that become cheaper and are purchased in greater quantities, as the index only incorporates the change in quantities, not prices. As a result, the Laspeyres quantity index biases real GDP growth upwards.*

**B. (10 minutes)**

You have just received an emergency instant message from your roommate, Jean, who is having a job interview in 10 minutes. Jean is a little rusty on economics, so you should answer clearly and intuitively.

**Limit your answer to ½ page of a bluebook.**

“Hey, the interviewer in this stupid little open economy where I live has been asking people the following question: What will happen to saving, investment, and the exchange rate when the stupid new government bans half of the imports? Help!”

*Remember the equation that \( NX(R) = S - I(r^w) \). When the government bans half of exports, the government forces a shift outward in the NX curve:

However, net saving \((S-I)\) does not change, so the real exchange rate must appreciate to balance \( NX \) with net domestic saving.*
II. (25 minutes).

Having bailed out your friend, you go back to your office. You get an email from another friend who teaches econometrics at Classica U. Your friend has estimated the behavioral equations of Lower Classica, which is a closed economy with flexible wages and prices, and gets the following:

\[
\begin{align*}
Y &= C + I + G \\
G &= 1000 \\
T &= 1000 \\
C &= 250 + 0.75(Y-T) \\
I &= 1000 - 50r
\end{align*}
\]

Variable definitions are \(Y\) = GDP, \(C\) = consumption, \(I\) = investment, \(G\) = government purchases, \(T\) = taxes, and \(r\) = real interest rate. Potential output in this economy is 5000. All variables are in constant prices.

a) Compute private saving, public saving, and national saving.

Public Saving: \(S_g = T - G = 1000 - 1000 = 0\)
Private Saving: \(S_p = (Y-T) - C = 750\)
National Saving: \(S^n = S_g + S_p = 750\)

b) Construct a graph showing the savings and investment schedules as a function of the real interest rate. Show the equilibrium interest rate.

c) Find the equilibrium interest rate algebraically.

\[
\begin{align*}
S &= I \\
750 &= 1000 - 50r \\
r &= 5
\end{align*}
\]
d) Now suppose that the government spends an additional 250 on buildings to teach classical and Austrian economics. What will happen to national saving and the interest rate? Show the impact of the expenditure graphically in the savings-investment diagram as well as algebraically.

Public Saving: \[ S^g = T - G = 1000 - 1250 = -250 \]
Private Saving: \[ S^p = (Y - T) - C = 750 \]
National Saving: \[ S^n = S^g + S^p = 500 \]

\[ S = I \]
\[ 500 = 1000 - 50r \]
\[ r = 10 \]
III. A balancing act (25 minutes): Solution

The following show the balance sheets of the central bank and commercial banks and dealers. Assume that the federal funds interest rate is currently 5 percent per year and that the required reserve ratio is 10 percent.

(a.) Show a figure with the supply and demand for money consistent with the balance sheet and interest rate.

(b. and c.) Show the associated IS-LM diagram. The FOMC determines that recessionary forces are increasing. What steps could the Fed take to lower short-term interest rates a little bit? Illustrate with both a new figure and two new balance sheets. Show how this changes the IS-LM curves.

The Fed would do open market operations to expand reserves and the money supply. Suppose that the Fed purchases bonds (say 10) from commercial banks, paying them by crediting their reserve accounts at the Fed. This increase of 10 in reserves means that commercial banks now have reserves in excess of the reserve requirements. As deposits expand, the interest rate falls. In the new equilibrium, the deposits increase by 100. The interest rate (federal funds) falls to \( i' \). Assuming prices are fixed, equilibrium \( r \) is originally 5% but falls to \( r'=i' \). See the figure and table below for the new equilibrium. The LM curve shifts out and down, lowering the interest rate and raising output.
### Central bank

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonds 2000</td>
<td>Cu 0</td>
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<tr>
<td>+10 Reserve</td>
<td>+10</td>
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</tbody>
</table>

### Commercial Banks and Primary Dealers

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
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<tbody>
<tr>
<td>Reserves 200</td>
<td>Checkable Deposits 2000 +10</td>
</tr>
<tr>
<td>+10 Investments 2000</td>
<td>+100 Equity 200 +100</td>
</tr>
</tbody>
</table>
(b. and c. continued)

(d.) Unfortunately, with further economic weakening, the economy moves into the liquidity trap, with substantial excess reserves. Illustrate with both a new figure and two new balance sheets.

This is where the U.S. is right now! As the Fed continues to buy assets in its OMOs, the money supply continues to increase and interest rates fall. Eventually, however, the interest rate hits the lower bound of zero, and the economy enters the liquidity trap. For the purposes of illustrating this situation with the balance sheet, suppose that \( i = 0 \) corresponds to reserves of 300.

At this point, further OMOs may increase reserves. But they cannot increase the money supply or demand because interest rates cannot fall and checkable deposits do not change. Further Open Market Operations simply add to excess reserves.

In the balance sheet below, ER (excess reserves) corresponds to Open Market Operations occurring after reserves are at 300. Note that further OMOs just increase ER but have no effect on the money supply!

<table>
<thead>
<tr>
<th>Central bank</th>
<th>Commercial Banks and Primary Dealers</th>
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</thead>
<tbody>
<tr>
<td>Assets</td>
<td>Liabilities</td>
</tr>
<tr>
<td>Bonds 2000</td>
<td>Cu 1800</td>
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<tr>
<td>+100+ER</td>
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<tr>
<td>Reserve</td>
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Final realistic note: At this point, the Fed may engage in “non-conventional policies.” It may decide to buy long-term bonds, or mortgage-backed securities, or other securities. These would affect longer-term interest rates. But for short-term rates, the Fed has “run out of bullets”!