Part I. True/False/Uncertain
Justify your answer with a short argument.

1. Paradox of saving occurs when the attempts by people to save more lead to a decline in output & an increase in saving.

   False. \( Y \downarrow \) \( S \) (no change) (page 60)

   Private saving:
   \[
   \begin{align*}
   S &= Y - C \\
   S &= Y - T - C \\
   \end{align*}
   \]

   Egmon Condition:
   \[
   \begin{align*}
   Y &= \bar{Y} \\
   Y &= C + I + G \\
   \end{align*}
   \]

   Why \( Y \downarrow ? \)
   \[
   \begin{align*}
   S &= Y - T - C \\
   S &= -C_0 + (1 - C_1)(Y - T) \\
   \end{align*}
   \]

   \( \text{when} \ \ C_0 \downarrow \)

   \( \circ \) \([ -C_0 ] \uparrow \rightarrow S \uparrow \)

   \( \circ \) \( C_0 \downarrow \rightarrow C \downarrow \rightarrow \bar{Y} \downarrow \rightarrow Y \downarrow \rightarrow S \downarrow \)

   * Consumers' decision to save more can't affect \( I, \ G \), nor \( T \). (by assumption)

   \( \because \) we know \( S \) did not change.

   * \( S \) does not change. (see eqn \( 2.2 \) book)

2. When mpc increases and investment decreases, goods market equilibrium output increases.

   Uncertain (graph 3-2)

   Goods Market:
   \[
   \begin{align*}
   \bar{Y} &= C + I + G \\
   \bar{Y} &= C_0 + C_1(Y - T) + I + G \\
   \end{align*}
   \]

   mpc: marginal propensity to consume \( (C_1) \)

   \( C_1 \) = slope of \( \bar{Y} \)

   \( C_1 \uparrow \) makes \( \bar{Y} \) steeper

   \( S_0, Y \uparrow \)

   \( I \downarrow \rightarrow \bar{Y} \) shifts down

   \( S_0, Y \downarrow \)

   Depends on how much \( \Delta I \ \& \ \Delta C_1 \)
3. If investment is really sensitive to changes in the interest rate \((b_1 \text{ large})\), then IS is flatter and fiscal policy is more effective.

**False.** When investment is really sensitive to changes in the interest rate, then IS is flatter but fiscal policy is less effective. This is because there will be more crowding out of investment, and therefore an increase in government spending will be less effective.

\[ \begin{align*}
I &= I(Y, i) \\
I &= b_0 - b_1i \\
\text{investment sensitivity to } \Delta i
\end{align*} \]

Let \( b_1 \) be large.

\[ \begin{align*}
\Delta I &
\end{align*} \]

\[ \begin{align*}
\Delta Y &= Y
\end{align*} \]

Start at \( A \).

Let \( i \downarrow \).

If \( b_1 \) is large, then \( Y \uparrow \uparrow \uparrow \).

\[ \begin{align*}
I \downarrow &
\rightarrow Y \uparrow \uparrow \uparrow \\
&
\text{large means for a given } \\
\Delta i, \Delta I \text{ is large and thus } \\
\Delta Y \text{ is large.}
\end{align*} \]

\[ \text{IS is Flatter} \]

4. The price of bonds increases when the interest rate rises.

**False** (page 74-75)

\[ \text{Price of Bonds } = \frac{\$100}{1+i} \quad \text{if } \$100 \text{ was the face value of a bond} \]

\[ \begin{align*}
i &\downarrow \rightarrow P_B \uparrow \\
i &\uparrow \rightarrow P_B \downarrow
\end{align*} \]

* If a bond promises to pay \$100 in a year, its face value is \$100 & \( P_0 \leq 100 \) if \( i > 0 \).
5. Monetary contraction and fiscal expansion increase equilibrium output and interest rate.

Uncertain: \( i \uparrow \) but \( \Delta Y \) uncertain (chapter 5)

**Monetary Contraction**

When the Fed \( M^s \downarrow \), \( i \uparrow \).

Given a level of \( Y \), \( i \) is higher so \( UM \) shifts up and left.

*3 possible outcomes...*

**Fiscal Expansion**

When \( \Delta Y \rightarrow \Delta \rightarrow Y \uparrow \)
at a given \( i \), higher \( Y \)
so \( IS \) shifts up and right.

Because at a higher (i. people demand less money)

- Option 1
- Option 2
- Option 3
6. The money multiplier is always less than 1.

False.

\[ 0 < \Theta < 1 \]
\[ \Theta = \text{reserve ratio} \]

\[ 0 < c < 1 \]
\[ c = \text{some constant} \]
\[ c \text{ is the proportion of } M^d \text{ (money demand) people hold as } C U^d \text{ (currency). Since people hold both } C U^d \text{ (currency) and } D^d \text{ (deposits), } c \text{ is between 0 and 1.} \]

Because \[ 0 < \Theta < 1 \] and \[ 0 < c < 1 \], money multiplier \( \left( \frac{1}{c + \Theta (1 - c)} \right) \) is always greater than 1. (see chapter 4)
Part II. THE MONEY MARKET
(all units are trillions of US $)

Money Demand: \( M^d = Y(0.2 - i) \)
Nominal Income: \( Y = 2000 \)
Money Supply: \( M^s = 300 \)

1. Find \( M^d \) for \( i = 10\% \) and \( i = 5\% \).

\[
\begin{align*}
\text{\( i = 10\% \)} & \quad \rightarrow \quad M^d = 200 = 2000 \cdot (0.2 - 0.1) \\
\text{\( i = 5\% \)} & \quad \rightarrow \quad M^d = 300 = 2000 \cdot (0.2 - 0.05)
\end{align*}
\]

2. What is the relationship between \( i \) and \( M^d \).

\[
\text{a negative relationship between} \quad i \quad \text{and} \quad M^d \quad \rightarrow \quad M^d = M^d (Y, i)
\]

\[ \text{i \uparrow \quad \rightarrow \quad M^d \downarrow} \quad \text{higher \quad \text{higher opportunity cost \quad of \quad holding money \quad \rightarrow \quad less money \quad (hold \ less)} \]

3. Graph \( M^s \) and \( M^d \).

\[
E_{gm} \rightarrow \quad M^s = M^d \\
300 = 2000 \cdot (0.2 - i) \\
\text{\( i = 0.05 \)}
\]

\[
\text{\( i = 5\% \)}
\]

4. Alan Greenspan decreases \( M^s \) by 50.

What happens to money market equilibrium? (solve & graph)

\[
E_{gm} \rightarrow \quad M^s = M^d \\
250 = 2000 \cdot (0.2 - i) \\
\text{\( i = 0.075 \)}
\]

\[
\text{\( i = 7.5\% \)}
\]

\[
\text{pt A} \Rightarrow \quad \text{old} \quad \text{egm} \\
\text{pt B} \Rightarrow \quad \text{new} \quad \text{egm}
\]
5. Describe how the Fed changes $i$ in the U.S.

The Fed can $\uparrow i$ by $\downarrow M^s$ (money supply).
The Fed can $\downarrow i$ by $\uparrow M^s$.

\[ i \uparrow \& M^s \downarrow \]

Part III. Money Multiplier

Checkable deposits: $D^d = 900$ billion
Total money supply: $M^s = 1800$ billion
Reserve ratio: $\theta = 0.2$

1. Find $CU^d$, $R^d$ and $D^d$ in equilibrium.

\[ M^d = CU^d + D^d \]
\[ M^s = M^d \quad \text{(in eqn)} \]
\[ R^d = \theta D^d \rightarrow R^d = 0.2(900) \]
\[ R^d = 180 \]
\[ D^d = P^d \]
\[ D^d = 900 \]

2. Find the money multiplier.

\[ H^d = CU^d + R^d \]
\[ H^d = c M^d + \theta (1-c) M^d \]
\[ H^d = \left( \frac{1}{c + \theta (1-c)} \right) M^d \]
\[ \text{money multiplier} \]

\[ mm = \frac{1}{c + \theta (1-c)} = \frac{1}{0.5 + 0.2(0.5)} \]

\[ mm = 1.67 \]

*When the Fed $\uparrow M^s$ by $\$100$, the overall $M^s \uparrow$ by $\$167$.
(see page 82 & 83)
3. Describe 2 different ways the Fed can decrease money supply.

(1) The Fed can sell bonds thru open market operations. This \( M^s \) (This decreases the \( M_s \) and increases \( i \))

(2) \( \uparrow \theta \) (The Fed can raise reserve ratio)

4. If the Fed wants to decrease the money supply by $500 million (in order to raise \( i \)), what amount of bonds would it have to sell/buy?

\[ mm = 1.67 \text{ (from part 2)} \quad (mm = \text{money multiplier}) \]

If the Fed wants the overall money supply to \( \downarrow \) by 500, it initially needs to \( \downarrow M_s \) (by selling bonds) by less than 500 due to the money multiplier.

Initially, the Fed will sell about $300 million worth of bonds.

\[ $300 \times mm = $300 \times 1.67 \approx $500 \text{ million} \]

* Make sure you can explain how the money multiplier works. (page 82-83)

\[ M^s \downarrow \rightarrow i \uparrow \]
Part IV. IS-LM
(All units are millions of US dollars)

\[ C = 200 + (0.25)Y_D \]
\[ I = 150 + 0.25Y - 1000i \]
\[ T = 200 \]
\[ G = 250 \]
\[ (M/P)^s = 1600 \]
\[ (M/P)^d = 2Y - 8000i \]

1. Find the equation for aggregate demand (Z).

\[ Z = C + I + G \]
\[ = 200 + (0.25)Y_D + 150 + 0.25Y - 1000i + 250 \]
\[ = 600 + 0.25(Y - 200) + 0.25Y - 1000i \]
\[ = 550 + 0.5Y - 1000i \]
\[ Z = 550 + 0.5Y - 1000i \]

2. Derive the IS equation.

IS eqn \[ \leftrightarrow \] Goods market eqn \[ \leftrightarrow \] \[ Y = Z \]
\[ Y = Z \]
\[ = 550 + 0.5Y - 1000i \]
\[ 0.5Y = 550 - 1000i \]
\[ Y = 1100 - 2000i \]
\[ i = (1100 - Y)(\frac{1}{2000}) \]

3. Derive the LM equation.

LM eqn \[ \leftrightarrow \] money (financial) market eqn \[ \leftrightarrow \] \[ M^s = M^d \]
\[ M^s = M^d \]
\[ \frac{(M/P)^s}{P} = \frac{(M/P)^d}{P} \]
\[ 1600 = 2Y - 8000i \]
\[ 2Y = 1600 + 8000i \]
\[ Y = 800 + 4000i \]
\[ i = \frac{Y}{4000} - \frac{1}{5} \]
4. Solve for equilibrium real output, i.e., Y, C,

\[ \text{egm} \iff \text{where IS \& LM intersect} \]

\[ \text{IS: } Y = 1100 - 2000i \quad \text{LM: } Y = 1800 + 4000i \]

\[ 1100 - 2000i = 1800 + 4000i \]
\[ 300 = 6000i \]
\[ 0.05 = i \]

\[ Y = 1100 - 2000(0.05) = 1000 \]

\[ Y^* = 1000 \]
\[ i^* = 5\% \]
\[ C = 400 \]
\[ I = 350 \]

5. Graph IS-LM of above with correct labels.

when graphing be sure to always have correct axis labels!

6. Monetary expansion:

Let \( M^s \) (nominal money supply) increase to 1840. Find equilibrium \( Y, i, C \) and \( I \). What happens to \( Y, i, C \) and \( I \) when the Fed increases money supply thru open market operations?

Money mkt \( \rightarrow \quad M^s = Md \)

\[ 1840 = 2Y - 8000i \]
\[ 2Y = 1840 + 8000i \]
\[ Y = 920 + 4000i \]

\[ \text{LM eqn} \rightarrow \quad 920 + 4000i = 1100 - 2000i \]
\[ 6000i = 180 \]
\[ i = 3\% \]

\[ \begin{array}{c}
\text{Money eqn} \\
1840 = 2Y - 8000i \\
2Y = 1840 + 8000i \\
Y = 920 + 4000i \\
\text{LM eqn} \\
920 + 4000i = 1100 - 2000i \\
6000i = 180 \\
i = 3\% \end{array} \]

Expansionary monetary policy reduces \( i \), increases \( Y, C, \) \& \( I \).

* notice that IS stayed the same.
only LM eqn changed \& shifted.
7. Graph part 6 (a new graph starting from part 5).

8. Fiscal expansion: (Continue from part 5)
Let G increase to 400. Find equilibrium $Y$, $i$, $C$ and $I$. What happens to equilibrium $Y$, $i$, $C$ and $I$ when government spending increases?

\[
\begin{align*}
\text{IS} - \text{LM} & \quad \rightarrow \quad 1400 - 2000i = 800 + 4000i \\
600 & \quad = \quad 6000i \\
10\% & \quad = \quad i
\end{align*}
\]

*note: with fiscal expansion, nothing is happening to $L$.*

9. Graph part 8 (a new graph starting from part 5).
10. There is a sudden drop in consumer confidence and $c_0$ drops from 200 to 100. How can the government counterbalance the drop in GDP using government spending as a policy instrument?

\[ c_0 \downarrow \rightarrow c \downarrow \rightarrow z \downarrow \rightarrow Y \downarrow \rightarrow IS \text{ shifts down and to the left} \]

The government can increase $z$ by 0, increase $G$ by 100, and do so:

\[ 0 \uparrow \rightarrow G \uparrow \rightarrow z \uparrow \rightarrow Y \uparrow \]

\[ \delta \downarrow \rightarrow I \downarrow \rightarrow Y_d \uparrow \rightarrow c \uparrow \rightarrow z \uparrow \rightarrow Y \uparrow \]