Goods Market (supply and demand for goods)

(1) \[ Y = C + I + G + NX \]
(2) \[ C = 20 + 0.5(Y - T) \]
(3) \[ I = 0.3Y - 100i \]
(4) \[ T = 20 \]
(5) \[ G = 20 \]
(6) \[ NX = -5 \]

Financial Market (supply and demand for liquidity/money)

(7) \[ M / P = 0.4Y - 200i \]
(8) \[ M = 30 \]

Labor Market (supply and demand for labor) and output-unemployment equation

(9) \[ P = (1 + m)W / A \]
(10) \[ W = A^e P^e (1 - u + z) \]
(11) \[ Y = AL(1 - u) \Rightarrow 1 - u = Y / AL \]

Parameters

\[ A = A^e = P^e = 1, L = 105, m = 0.05, z = 0 \]

Equations (1)-(11) provide a complete description of the economy. Technically, they are 11 equations in 11 unknown variables: GDP \( Y \), Consumption \( C \), Investment \( I \), Taxes \( T \), Government Spending \( G \), Net Exports \( NX \) Liquidity or Real Money Demand \( (M / P)^d \), Money Supply \( M \), Prices \( P \), Wages \( W \), and the unemployment rate \( u \). All variables are as defined in the textbook and class.

Equations (1)-(6) describe the goods market and (7)-(8) describe the financial market. Equations (9)-(10) describe the labor market. Equation (11) relates the unemployment rate to output: increased unemployment \( u \) is linked to less output \( Y \).
The assignment has five goals.

1. Describe the goods market by compacting (1)-(6) into a single IS equation.

2. Describe the financial market by compacting (7)-(8) into a single LM equation.

3. Find IS-LM equilibrium output $Y$. The answer – an equation where $Y$ depends on $P$ - is the Aggregate Demand (AD) equation for goods in America.

4. Describe the labor market by compacting (9)-(11) into an Aggregate Supply (AS) equation.

5. Combine AD and AS to find output $Y^*$ in America as well as the price level $P^*$. For completeness, let us also find $C$, $I$, $(M / P)^d$, $W$, and $u$, and check our calculations.

To achieve these goals we can proceed as follows:

(a) Substitute (2)-(6) into (1) and solve for GDP ($Y$). The answer is not a number but depends on the interest rate ($i$). This is your IS equation.

(b) Substitute (8) into (7) and solve for the interest rate ($i$). The answer is not a number but depends on GDP ($Y$) and the price level $P$. This is your LM equation.

(c) Substitute the LM equation for $i$ into the IS equation and solve for $Y$. The answer will depend on the price level $P$. This is the AD equation.

(d) Substitute (10) into (9). Then substitute (11) into the equation you just found. This is the AS equation.

(e) Substitute the AS equation into the AD equation and solve for $Y$. (Hint: for a quadratic equation $ax^2 + bx + c = 0 \iff x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$). Then use $Y$ in the AS equation to find the price level $P$. Draw a diagram with $Y$ on the horizontal axis, $P$ on the vertical axis and the AD and AS curves. Write in the equations next to each curve and mark the equilibrium values of $Y$ and $P$.

(f) Using equations (2) and (4), find consumption $C$. Using the LM curve or (7)-(8), find the interest rate $i$. Then, using (3), find investment $I$. Using (7), find real money demand $(M / P)^d$. Using (11) find the unemployment rate $u$. Using (10), find the wage $W$.

(g) Check your calculations: is $Y = C + I + G$? Is $M / P = 0.4Y - 200i$? Is $P = (1 + m)W / A$?