Problem Solving / Essay Questions. (75 points)

#11. (30 pts) In the U.S., currency in circulation (C) is $1.2 trillion and the monetary base (B) is $3.7 trillion. Assume the reserve-deposit ratio (rr) and the currency-deposit ratio (cr) are both 0.25.

(a) (10 pts) What is the size of bank reserves (R)? What is the money multiplier? What is the money supply? What is the velocity of money if nominal GDP is $17 trillion?

- **Bank reserves (R) are the difference between the monetary base (B) and currency (C): $R = B - C = \$2.5$ trillion.**
- **The money multiplier (m) is**

$$m = \frac{1+cr}{cr+rr} = \frac{1.25}{0.5} = 2.5.$$

- **The money supply (M) is $M = mB = 2.5 * \$3.7$ trillion $= \$9.25$ trillion.**
- **The velocity of money is $V = \frac{\$17\ trillion}{\$9.25\ trillion} = 1.84.$**

(b) (10 pts) If the FOMC increases bank reserves (R) by $0.5 trillion and banks choose to hold all the additional reserves rather than loan them out, what is the new money supply? [5 PT BONUS: What is the new money supply if instead banks loan out 50% of the additional new reserves and households deposit all the additional loans?]

[Correction: If the FOMC increases reserves and banks do not loan the reserves, then the money supply stays the same at $9.25 trillion, but the monetary base increases by $0.5 trillion to $4.2 trillion.] BONUS: If banks instead loan out 50% of the additional reserves and none is held as currency, then the multiplier for the new reserves is $m = 2$. Therefore the money supply increases by $1 trillion to $10.25 trillion.**

(c) (10 pts) Assume that the velocity of money is constant and real GDP is growing at 1%. Use the numbers in part (a) to answer the next question. If the Fed wishes to keep the price level constant, how much (in dollars) do they need to increase the money supply?

The quantity equation in percentage change is $\%\Delta M + \%\Delta V = \%\Delta P + \%\Delta Y$. If V is constant and Y is growing by 1%, then the Fed needs to increase M by 1% to achieve a stable price level: $\pi = \%\Delta P = 0\%$. From part (a), we know that M = $9.25 trillion. The Fed needs to increase the money supply by $92.5 billion.

#12. (30 pts) Consider the following Neoclassical model of the economy, where the domestic interest rate r and the world interest rate r_* are in percentage terms. Show all your work.

Supply	Demand
$Y = 500$	$C = 100 + 0.9(Y - T)$
$NX = 50 - 10\epsilon$	$I = 100 - 5r$
$r_* = 10\%$	$G = 0, T = 100$

(a) (10 pts) Find the equilibrium real interest rate, national saving, and investment in a <u>closed</u> economy. Show the equilibrium real interest rate on a saving-investment diagram with r measured on the vertical axis. Carefully label both axes.

- **National saving is $S = Y - C - G = 500 - 100 - 360 = 40$.**
- **Investment is $I = 100 - 5(12) = 100 - 60 = 40$.**
- **The equilibrium real interest rate is $r = 12\%$.**
- **See Figure 3.8 in the textbook.**

(b) (10 pts) Now assume the small economy opens up to trade. Calculate the real exchange rate, trade balance and net capital outflow. Show the trade balance on a saving-investment diagram with ϵ measured on the vertical axis. If $P = 2$ and $P_* = 1$, what is the nominal exchange rate?

- **National saving remains $S = 40$.**
- **Investment is now $I = 100 - 5(10) = 100 - 50 = 50$.**
- **Net capital outflow is $S - I = 40 - 50 = -10$.**
- **Net exports are $NX = S - I = -10$.**
- **The real exchange rate is $\epsilon = 6$.**
- **The nominal exchange rate is $e = 6 * 0.5 = 3$.**
- **See Figure 6.8 in the textbook.**

(c) (10 pts) Consumers in the small open economy suddenly desire fewer foreign goods, shifting the net exports schedule to $NX = 100 - 10\epsilon$. Find the new real exchange rate, nominal exchange rate, trade balance and net capital outflows. Redraw the diagram from part (b) to show the changes.

- **The shift in net exports will not affect the trade balance.**
- **Net exports and net capital outflows remain at -10.**
- **The new real exchange rate is $\epsilon = 11$.**
- **The new nominal exchange rate is $e = 5.5$.**
- **See Figure 6.12 in the textbook.**

#13. (15 pts) True or False. If "False", state why it is false.

Problem Solving / Essay Questions. (75 points)

#11. (30 pts) Assume the monetary base (B) is $100 billion, the reserve-deposit ratio (rr) is 0.1, and the currency-deposit ratio (cr) is 0.1. Show your work.

(a) (10 pts) What is the money supply?

The money supply is given by the monetary base (B) times the money multiplier (m). This is

$$M = B * m = B * \left(\frac{1+cr}{cr+rr}\right) = \$100 * \left(\frac{1+0.1}{0.1+0.1}\right) = \$100 * \left(\frac{1.1}{0.2}\right) = \$550 \text{ billion.}$$

(b) (10 pts) If cr changes to 0.2, but rr is 0.1 and B is unchanged, what is the money supply?

The new money supply is

$$M = B * \left(\frac{1+cr}{cr+rr}\right) = \$100 * \left(\frac{1+0.2}{0.2+0.1}\right) = \$100 * \left(\frac{1.2}{0.3}\right) = \$400 \text{ billion.}$$

(c) (10 pts) Using your answer from part (b), what is the velocity of money if nominal GDP is $800 billion? What is the resulting level of inflation if velocity is constant, real GDP increases by 2%, and the money supply increases by 4%?

The income velocity of money is given by

$$V = \frac{PY}{M} = \frac{\$800}{\$400} = 2.$$

Inflation is given by

$$\pi = \frac{\Delta M}{M} - \frac{\Delta Y}{Y} = 4\% - 2\% = 2\%.$$

#12. (30 pts) Consider the following Neoclassical model of the economy, where the domestic interest rate r and the world interest rate r_* are in percentage terms. Show all your work.

Supply	Demand
$Y = F(K, L) = \sqrt{KL}$	$C = 10 + 0.8(Y - T)$
$K = 100; L = 64$	$I = 20 - 2r$
$r_* = 5\%$	$G = 30, T = 50$

(a) (10 pts) What is the level of GDP in the economy? In a closed economy, find the equilibrium real interest rate, national saving, and investment.

Real GDP is given by $Y = F(K, L) = \sqrt{100 \times 64} = 80$. In order to find the closed-economy interest rate, we set national saving (S) equal to investment (I). National saving is $S = Y - C - G = 80 - 34 - 30 = 16$. Investment is given by $I = 20 - 2r$. This implies that $r = 2\%$ in order to guarantee that $S = I$.

(b) (10 pts) Calculate the trade balance and net capital outflow for the small open economy. Show the trade balance on a saving-investment diagram with r measured on the vertical axis.

In a small open economy, investment is given by $I = 20 - 2r_* = 10$. National saving is still equal to $S = 16$. This implies that net exports and net capital outflows are given by $NX = S - I = 16 - 10 = 6$. See figure 6.4 in the text.

(c) (10 pts) Calculate the new level of the trade balance if fiscal policymakers lower taxes to balance the federal budget. Redraw the diagram from part (b) to show the change in the trade balance.

If policymakers lower taxes to $T = 30$, then national saving is given by $S = Y - C - G = 80 - 50 - 30 = 0$. Investment is still given by $I = 20 - 2r_* = 10$. This implies that net exports and net capital outflows are now given by $NX = S - I = 0 - 10 = -10$. The economy goes from running a trade surplus to running a trade deficit. See figure 6.3 in the text.