1. Econometric estimates of the production of raspberries results in $R = K^{0.4}L^{0.6}$ where $R$ represents the number of gallons of raspberries picked, $K$ the number of raspberry-picking machines being used, and $L$ the number of workers employed. Using this production function, answer the following questions:

a. Does this production function exhibit increasing, decreasing or constant returns to scale? (2)

b. What is the equilibrium rental rate of capital paid to raspberry machine owners? (6)

c. What fraction of total income is received by owners of raspberry machines? (4)

d. If Congress allows immigration to raise the labor force in the raspberry market by 5%, what will happen (precisely) to the rental rate of capital paid to raspberry machine owners? What about the fraction of total income received by owners of raspberry machines? Explain your answer. (8)
2. Consider an economy that is described by the following equations:

\[ Y = C + I + G, \quad C = a + b(Y - T), \quad I = I(r), \quad G = \bar{G}, \quad T = \bar{T}, \quad \text{and} \quad Y = \bar{Y}, \]

where \( 0 < b < 1 \) and \( \frac{dI}{dr} < 0. \)

a. On the graph below, plot the savings supply and investment demand curves indicated by the above equations. Label the equilibrium interest rate \( r_a \) and the equilibrium level of savings \( s_a \). (4)

b. One result of the recent “mortgage meltdown” has been that businesses, especially homebuilders, have been reluctant to undertake projects that increase housing capital. On the plot above, demonstrate the impact of this change in sentiment. In the space below, describe the resulting impact on the quantity of investment and the real interest rate. (6)
c. One cause for concern with the above model is that taxes are assumed to be exogenous. However, under the American system, individuals earning interest income must pay taxes on this revenue. Consider a tax function represented by $T = t(r)$ where $t$ simply represents an implicit function. Assume further that $\frac{dT}{dr} > 0$. 

Assuming that all other equations are the same as presented in part a, on the graph below plot the resulting savings supply and demand curves. (6)

![Graph showing national savings with axes labeled r and National Savings.]

d. Compare the change in business investment demand implied in part b under the two tax scenarios implied by parts a and c of this problem. Under which situation do interest rates change more? Under which scenario does investment change more? Why does this happen? (6)
3. Consider the following equations describing a Solow economy:

\[ Y = K^{3}(LE)^{7}, \quad s = .09, \quad \delta = .03, \quad n = .01, \quad g = .02 \]

a. Solve for the effective per capita production function for this economy. (2)

b. Solve for the steady state level of capital per effective worker, output per effective worker and consumption per effective worker. (9)
c. Imagine that the economy described in part a of this problem begins time \( t_0 \) with 2 units of capital per effective worker. Assume that investment demand rises at the same rate as real GDP. Further, assume that by time \( t_1 \) this economy has achieved the steady state level of capital. On the left-hand side of the plots below, diagram the movement of the requested variables between time \( t_0 \) and time \( t_1 \). (10)

\[\begin{array}{c|c|c|c|c}
& k & y & \frac{Y}{L} & Y \\
\hline
t_0 & & & & \\
\hline
t_1 & & & & \\
\end{array}\]

\[\text{Time}\]

\[\begin{array}{c|c|c|c|c}
r & & & & \\
\hline
t_0 & & & & \\
\hline
t_1 & & & & \\
\end{array}\]

\[\text{Time}\]

d. At time \( t_1 \), this economy discovers computers which advance the growth rate of technology to \( g' \) where \( g' > g \). Plot the evolution of this economy after time \( t_1 \) as it approaches its new steady state. (10)
e. Given the increase in the growth rate of technology from \( g \) to \( g' \), what will happen in the long run to consumption? Why? (6)

4. Imagine that the heavy construction labor industry can be described by the following equations:

\[
\begin{align*}
\text{Labor Supply:} & \quad \frac{W}{P} = 5 + 2L \\
\text{Labor Demand:} & \quad \frac{W}{P} = 20 - L
\end{align*}
\]

Where \( L \) measures thousands of workers and \( W/P \) is the real wage earned over the course of a month.

a. What is the equilibrium real wage in this market? How much labor is hired? What is the unemployment rate in equilibrium? (6)
b. As the construction industry is highly variable, workers in this industry have a 5% chance each month of being laid off. What is the expected value of this job to the worker? (4)

c. Imagine that when going to work, workers make a decision to work hard or to slack-off while working. If workers work hard they incur an extra burden in the form of sore muscles that costs the worker an equivalent of 6 units of real wage per month. Workers that slack incur no such additional costs but will be fired with 15% more frequency than workers that work hard (they lose their jobs with 20% probability as opposed to 5%). If firms want all of their workers to work hard, what wage will firms pay their workers? What is the unemployment rate? (8)

5. In the country of Whatcom, the velocity of money is constant. Real GDP grows at 6 percent per year, the money stock grows at 12 percent per year, and the nominal interest rate is 9 percent. What is Whatcom’s real interest rate? (5)