Part A (9 points) Fill-in Questions

(1) [3 points] The steady state with the highest consumption is called the Golden Rule level of capital.

(2) [3 points] The number of effective workers takes into account the number of workers and the efficiency of each worker.

(3) [3 points] In the United States, the primary way in which the Federal Reserve controls the supply of money is through open-market operations—the purchase and sales of government bonds.

Part B (31 points)

(1) [8 points] Money and Inflation

(a) [4 points] What are three functions of money?

Medium of exchange, unit of account, and store of value

(b) [4 points] Money demand in an economy in which no interest is paid on money is $M/P = 0.2Y$, where $Y$ is national income. Suppose that $P = 100$, $Y = 1000$. What is income velocity of money?

The quantity equation is $MV = PY$ or $M = \frac{1}{V}Y$. Therefore, income velocity of money is $V = \frac{Y}{M/P} = \frac{Y}{0.2Y} = 5$
(2) [9 points] Solow-Swan Model

Answer the following questions using the Solow-Swan model with growing population and no technological progress

(a) [6 points] It rains so much in the country A that capital equipment rusts out (depreciates) at a much faster rate than it does in the country B. If the countries are otherwise identical, in which country will the Golden Rule level of capital per worker be higher? Illustrate graphically

Country B has a higher Golden Rule level of capital per worker, \( y_A^g < y_B^g \)

(b) [3 points] Which country will have the faster rate of growth of output per worker in the steady state? Why?

In the steady state, both countries have the same rate of growth of output per worker. Note that the growth rate of output per worker is 0 in this model
(3) [14 points] According to the Solow-Swan model, how much a nation saves and invest is a key determinant of its citizen’s standard of living. The saving rate determines the steady-state levels of capital and output. One particular saving rate produces the Golden Rule steady state ($k^g$), which maximizes consumption per worker and thus economic well-being. To decide whether a country is at, above, or below the Golden Rule steady state, we need to compare marginal product of capital net of depreciation ($MPK - \delta$) with the growth rate of total output ($n + g$), where $\delta$ is depreciation rate, $n$ is population growth rate and $g$ is the rate of technological progress. Let’s consider the following four facts.

(i) The capital stock is about 2.5 times one years GDP ($k = 2.5y$)
(ii) Depreciation of capital is about 10 percent of GDP ($\delta k = 0.1y$)
(iii) Capital income is about 30 percent of GDP ($MPK \times k = 0.3y$)
(iv) GDP grows 3 percent per year ($n + g = 0.03$)

where $k$ is capital-labor ratio and $y$ is per capita GDP.

(a) [8 points] Is the steady-state capital per worker at, below, or above the Golden Rule level of capital per worker, $k^g$? Show your work

We solve for $\delta$ by dividing (ii) by (i): $\delta = 0.04$. Dividing (iii) by (i) yields $MPK = 0.12$. Thus, the net marginal product of capital ($MPK - \delta$) is 8 percent per year. Since the return to capital is well in excess of the economy’s growth rate, the capital stock in this country is well below the Golden Rule level

(b) [6 points] If policymakers care equally about all generations, would you pursue policies to reach the Golden Rule steady state? Give an example of such a policy

When the economy begins below the Golden rule level of capital, reaching the Golden rule level means reducing consumption today to increase consumption in the future. If the policymaker cares equally about all generations, then he or she chooses to reach the Golden Rule. Even though the current generation will have to consume less, an infinite number of future generations will benefit from increased consumption by moving to the Golden Rule. Therefore, policy makers should increase national saving through a budget surplus or low tax rates on capital — including the corporate income tax, the federal income tax, and the estate tax.