ECON 312 - Long Run Growth Study Questions

1 True, False or Uncertain

Answer each of the following questions either true, false, or uncertain and explain your answer. The *explanation* is the most important part of your answer.

1. Consider the growth accounting formula

$$y - n = a + b(k - n)$$

where y is the growth rate of real output, a is the growth rate of productivity, k is the growth rate of the capital stock, and n is the growth rate of the labor force. The growth rate of the population in the United Sates has been very small (about 1%) for the past several decades. If the Federal government places large restrictions on immigration, this will improve the long-run growth of the economy.

2. When the Solow growth model is in steady-state equilibrium, per capita savings exceeds per capita consumption.

 $\frac{Y}{N}$

 $\frac{Y}{N}$

3. According to the Solow growth model, a permanent decrease in the aggregate savings rate leads to a permanent decrease in the growth rate of real output.

4. According to the Solow growth model, an increase in the growth rate of the labor force increases both the level of real per capita GDP and the steady-state equilibrium growth rate of real GDP.

5. According to the Solow growth model an increase in the depreciation rate on capital reduces both the level of real per capita GDP and the steady-state equilibrium growth rate of real GDP.

 $\frac{K}{N}$

2 Analysis

Answer the following questions in the space provided.

- 1. Aggregate Income (or Output) per person is widely used by economists as a measure of the standard of living in a country. Developing or third World economies have a much lower standard of living than industrialized countries; developing economies also tend to have a smaller stock of capital per worker than industrialized economies.
 - 1.a Set-up and solve a macroeconomic model which shows how per-capita output and per-capita capital stock are determined in an economy. Be sure to include the role of savings, productivity, depreciation of the capital stock, growth of the labor force, and per-capita savings and consumption in your model; provide a brief description of the role each of these factors plays in the model. Also, clearly label the "steady state" equilibrium level of real per capita output and the capital-labor ratio.

1.b Show the effects of a one time increase in productivity on per capita output and the capital-labor ratio. Also show the effects of this change on savings and consumption per person.

1.c Consider two different countries, W and Y. Country W is a "developed" country and country U is a "developing" country. Assume that the per capita production function, the growth rate of the labor force, the capital depreciation rate, the aggregate savings rate, and the level of technology are identical in each country. The only difference is that the capital-labor ratio in W is higher than the capital-labor ratio in U. Ont the following two graphs, show the determination of real output per person and the capital-labor ratio in each economy.



1.d Under the assumptions in the previous question, can $\left(\frac{Y}{N}\right)_W > \left(\frac{Y}{N}\right)_U$ in the long-run? Explain.

1.e Since the Second World War, per capita output in many Third World economies has lagged far behind pre capita output in industrialized economies. How does this fact relate to the previous two questions and which of the assumptions listed above is most likely incorrect? 2. The following table shows the growth rates of per capita output in the United States and the Federal Republic of Germany in the 1970s and 1980s:

	1970-79	1980-89
U.S.	3.12%	2.75%
Germany	3.13%	1.65%

2.a Write down a macroeconomic model which explains the determination of real per capita output in an economy. Define and explain the following concepts in the context of this model: per capita aggregate production function, per capita aggregate savings, per capita actual investment, per capita steady-state investment, steady-state equilibrium, growth rate of the labor force, growth rate of the capital stock, growth rate of real output.

2.b Explain, in the context of the model described above, why per capita output increases over time in an economy.

2.c Suppose you learn that the government budget deficit increased in the United States in the 1980s while the German government kept a balanced budget during the same period. Does this explain the behavior of the growth rate of real per capita output in the two countries shown on the table? Use a graph to illustrate your answer.



- 3. Robert Solow moderated a national "teach-in" on economics held in Little Rock Arkansas in 1992, at the outset of the Clinton administration. Solow, and other economists at the "teach-in" remarked that the United States was plagued by an "investment gap." That is, at that time the United States invested much less than our primary competitors Japan and West Germany.
 - 3.a Using Solow's model of long-run economic growth, show how the capital-labor ratio and the level of real per capita output are determined in an economy. Clearly label the axes and explain steady-state equilibrium in the context of this model.

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3.b Assume that the growth rate of the population, the depreciation rate of capital, and the aggreagate per capita production function are identical in the U.S. and Japan. Using two graphs, one for the U.S. and one for Japan, identify the "investment gap" and explain why it is important in the context of this model.



3.c Over the next eight years, the Clinton administration pursued a policy of deficit reduction. Explain how this policy could have closed the "investment gap" identified by Professor Solow in 1992.



4. Suppose that the autonomous growth factor (A), the growth rate of the labor force (n), the depreciation rate on capital (d), the total savings rate (s), and the production function $(f(\cdot))$ are identical in two economies, Economy T and Economy D. The only difference between these economies is that the capital-labor ratio in Economy T is initially lower than the capital-labor ration in Economy D. 4.a Using the Solow growth model, show the initial capital-labor ratio and the level of real per capita GDP in each economy; label the initial values.

Economy D **Economy** T



4.b Can this model explain why real pre capita GDP in Economy T would be lower than in Economy D for a period of decades? Explain your answer.

Economy D Economy T

4.c Suggest one reason that real per capita GDP in Economy T might be persistently lower than real per capita GDP in Economy D. Explain your answer.

4.d Set up and solve a model which shows how real per-capita GDP and real capital per worker are determined in an economy. Be sure to include the role of savings, productivity, depreciation of physical capital, and per capita savings and consumption in your model; provide a brief description of the role each of these factors plays in the model. Also, clearly label the "steady state" equilibrium level of real per capita GDP and capital per person.

^{4.}e Show the effects of a one time increase in autonomous productivity on real per capita income and the capital-labor ratio in the Solow growth model. Also show the effects on per capita saving and consumption.