Nanyang Technological University
School of Social Sciences

HE2002 Macroeconomics II

Tutorial 10

1. **Chapter 11, Q7. The Cobb-Douglas production function and the steady state.**
   This problem is based on the material in the chapter appendix. Suppose that the economys production function is given by

$$Y = K^{\alpha} N^{1-\alpha} \tag{1}$$

   and assume that $\alpha = 1/3$

   (a) Is this production function characterized by constant returns to scale? Explain.

   (b) Are there decreasing returns to capital?

   (c) Are there decreasing returns to labor?

   (d) Transform the production function into a relation between output per worker and capital per worker.

   (e) For a given saving rate, s, and depreciation rate, δ, give an expression for capital per worker in the steady state.

   (f) Give an expression for output per worker in the steady state.

   (g) Solve for the steady-state level of output per worker when $s = 0.32$ and $\delta = 0.08$.

   (h) Suppose that the depreciation rate remains constant at $\delta = 0.08$, while the saving rate is reduced by half, to $s = 0.16$. What is the new steady-state output per worker?

2. **Chapter 11, Q8**
   Continuing with the logic from Problem 7, suppose that the economys production function is given by $Y = K^{1/3}N^{2/3}$ and that the saving rate, s, and the depreciation rate, δ are equal to 0.10.

   (a) What is the steady-state level of capital per worker?

   (b) What is the steady-state level of output per worker?

   Suppose that the economy is in steady state and that, in period t, the depreciation rate increases permanently from 0.10 to 0.20.

   (c) What will be the new steady-state levels of capital per worker and output per worker?

   (d) Compute the path of capital per worker and output per worker over the first three periods after the change in the depreciation rate.

3. **Chapter 11, Q9. The saving rate and changes in the capital stock**
   Suppose that in your country, the saving rate slowly declines from 12% in year t to 11% in year $t+1$ and 10% in year $t+2$. Suppose, moreover, that the depreciation rate, δ, is 10%.

   (a) Using the production function given in the chapter, what happens to the steady-state capital stock per worker and the steady-state output per worker before and after changes in the saving rate? Briefly discuss how capital stock per worker and output per worker may evolve over time between the two steady states from period t to $t+3$.

   (b) Due to technological progress, assume that the depreciation rate increases to 12% at time t (remaining stable afterwards). What is the new steady-state capital stock per worker? What is the new steady-state output per worker? How does this compare to your answer to part a?