Nanyang Technological University
School of Social Sciences

HE2002 Macroeconomics II

Solution to Tutorial 11

1. **Chapter 11, Q6.**

   (a) Under steady state, $sf(\frac{K}{N}) = \delta\frac{K}{N}$, $\frac{K}{N} = \frac{9s^2}{\delta^2}, \frac{Y}{N} = \frac{9s}{\delta}$.

   (b) $\frac{C}{N} = (1-s)\frac{Y}{N} = \frac{9s}{\delta}(1-s)$

   (c) Refer to the table below:

	$s = 0$	$s = 0.1$	$s = 0.2$	$s = 1$
$\frac{Y}{N}$	**0**	**45**	**90**	**450**
$\frac{C}{N}$	**0**	**40.5**	**72**	**0**

   As the saving rate s grows, steady-state level of output per worker increases, while steady-state level of consumption per worker first increases and declines after a threshold.

   (d) $\frac{C}{N} = \frac{9s}{\delta}(1-s)$, $\frac{C}{N}$ is maximized when $s = 0.5$ (FOC). The formal maximization problem is:

$$\max_s \quad \frac{9s}{\delta}(1-s),$$

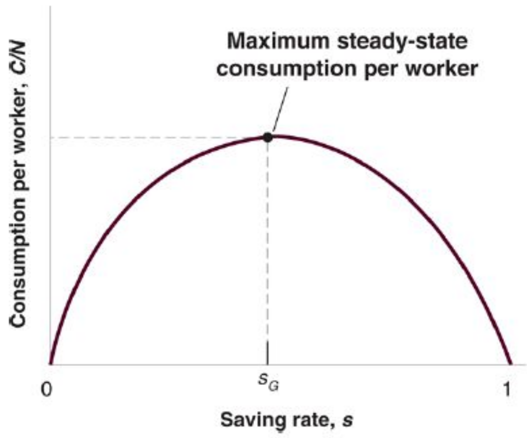
   whose solution should be quivalent to the solution to the following problem:

$$\max_s \quad \frac{s}{(1-s)},$$

   Taking F.O.C gives

$$1 - s - s = 0.$$

   Therefore the saving rate equals to 0.5.



2. **Chapter 12, Q6.**

(a) i. $\frac{K}{AN} = (\frac{s}{\delta+g_A+g_N})^2 = 1$

ii. $\frac{Y}{AN} = (\frac{K}{AN})^{\frac{1}{2}} = 1$

iii. $g_{\frac{Y}{AN}} = 0$

iv. $g_{\frac{Y}{N}} = g_A = 4\%$

v. $g_Y = g_A + g_N = 6\%$

(b) i. $\frac{K}{AN} = (\frac{s}{\delta+g_A+g_N})^2 = 0.64$

ii. $\frac{Y}{AN} = (\frac{K}{AN})^{\frac{1}{2}} = 0.8$

iii. $g_{\frac{Y}{AN}} = 0$

iv. $g_{\frac{Y}{N}} = g_A = 8\%$

v. $g_Y = g_A + g_N = 10\%$

An increase in the rate of technological progress reduces the steady-state levels of capital and output per effective worker, but increases the rate of growth of output (per worker).

(c) i. $\frac{K}{AN} = (\frac{s}{\delta+g_A+g_N})^2 = 0.64$

ii. $\frac{Y}{AN} = (\frac{K}{AN})^{\frac{1}{2}} = 0.8$

iii. $g_{\frac{Y}{AN}} = 0$

iv. $g_{\frac{Y}{N}} = g_A = 4\%$

v. $g_Y = g_A + g_N = 10\%$

People are better off in case (a). Given any set of initial values, the level of technology is the same in cases (a) and (c), but the level of capital per effective worker is higher at every point in time in case (a). Thus, since $\frac{Y}{N} = \frac{K^{1/2}(AN)^{1/2}}{N} = \frac{K^{1/2}}{(AN)^{1/2}}\frac{(AN)^{1/2}}{N}(AN)^{1/2} = \frac{K^{1/2}}{(AN)^{1/2}}A$, and thu output per worker is always higher in case (a). Given that saving rate is the same in both (a) and (c), and thus $\frac{C}{N} = (1-s)\frac{Y}{N}$ is higher in (a), people are better off.