Problem Set 1
due Monday, March 21^{st}

Problem 1.(1 point). Download data on the per capita real GDP and population size from Penn World Tables (google it) for all countries. Compute real GDP for each country, as well as the world population and world GDP. Compute average world GDP per capita. For each country compute its share in the world GDP (%GDP) and in the world population (%POP); and its GDP per capita relative to the average world income per capita (RI). The following table shows, for example, that countries with GDP per capita at least 4 times higher than the world average produced 24.55% of the world GDP, and were populated by only 5.82% of the world population in 1985.

RI	%GDP	%POP
>4	24.55	5.82
2-4	32.84	11.69
1-2	15.86	12.89
0.5-1	5.88	8.06
0.25-0.5	15.71	33.70
<0.25	5.16	27.84

Reproduce the same graph for 2005. Comment on the changes in world income distribution.

Problem 2. (0.5 points). Compute average annual growth rates of GDP per capita in China and the United States in 1987-2007 (average growth rate in this case is defined as $(\frac{y_{2007}}{y_{1987}})^{0.05}-1$). If GDPs per capita continue growing at the same rates, when will China and the U.S. have the same levels of GDP per capita?

Problem 3. (0.5 points). Go to Gapminder.org (world section) and have some fun with the data. Find at least three socio-economic indicators that are correlated with income per person and are important for the quality of life. Be creative (do not use life expectancy which is a default variable in the Gapminder world section).

Problem 4. (1 point). Consider a CES (constant elasticity of substitution) production function

$$Y_t = A_t[\alpha K_t^{\rho} + (1-\alpha)L_t^{\rho}]^{\frac{1}{\rho}}, \qquad \alpha\epsilon(0,1), \qquad \rho\epsilon(-\infty;1]$$

a) Find income shares of capital and labor (assume competitive markets).

b) Is this production function neoclassical? Which of the neoclassical conditions does it satisfy and which ones does it not?

Problem 5. (1 point). Go to `www.bornukova.com/teaching/macro4`. Download an Excel file with the data on the United States.

a) Compute income share of capital. Do a graph with its evolution over time. Does it display a trend?

b) Do the growth accounting exercise: compute the contribution of technology into output growth using the primal approach. Use the following formula:

$$log[A_{t+1}/A_t] \approx log[Y_{t+1}/Y_t] - s_K(t)log[K_{t+1}/K_t] - (1 - s_K(t))log[A_{t+1}/A_t]$$

What is the average contribution of technology into the growth rate of income? What are the average contributions of labor and capital?

Problem 6. (1 point). Consider a Solow model with Cobb-Douglas aggregate production function $Y_t = AK_t^{\alpha}L_t^{1-\alpha}$, $\alpha\epsilon(0,1)$. Assume technology is constant, population grows at the rate n, capital depreciates at the rate δ, and a constant share of income s is saved.

a) Show that if the markets for capital and labor are competitive, income shares of capital and labor are constant.

b) Derive the fundamental equation of Solow-Swan model.

c) Find steady state values of capital, income and consumption.

d) Find the savings rate s_{gold} that maximizes the steady state level of consumption.

e) Assume at time $t = t_1$ the savings rate changes from s_1 to s_{gold}, $s_1 < s_{gold}$. What happens to the level of k, y and c and the moment t_1? What happens to $\dot{k}$, $\dot{y}$ and $\dot{c}$?

f) What effect do the following changes have on steady state quantities of k, y and c?

- part of physical capital is destroyed;

- technology level A goes up;

- savings rate goes up;

- population growth rate goes up;

- the share of capital α goes up.