Instructions. Please submit only one paper per group, via Blackboard. Please make sure that the printed output of your files is intelligible. Unless indicated otherwise, let $\alpha = 1/3$.

1. **France and the US.** France and the US are among the most successful economies in the world, but a closer look suggests some differences. In France, output per capita is lower, but since a smaller fraction of the population works and each worker works fewer hours, output per hour worked is not much different. Our goal is to explain these differences.

Consider the data for 2009:

<table>
<thead>
<tr>
<th>Country</th>
<th>GDP</th>
<th>Capital</th>
<th>Employment</th>
<th>Hours</th>
<th>Education</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>1.985</td>
<td>5.542</td>
<td>29.51</td>
<td>1,554</td>
<td>10.4</td>
<td>64.42</td>
</tr>
<tr>
<td>US</td>
<td>12.618</td>
<td>35.540</td>
<td>155.45</td>
<td>1,768</td>
<td>13.25</td>
<td>307.0</td>
</tr>
</tbody>
</table>

GDP and capital are reported in trillions of 2005 US dollars, employment and population in millions, and education in years. Hours is the average number of hours per year worked by an employed person. Total hours worked can be computed as the product of employment (the number of people working) and hours (the number of hours per worker).

(a) Compute output per capita, output per worker, and output per hour worked. (10 points)

(b) What are the primary sources of the difference in output per capita? Suggestion: use total hours worked as your measure of the quantity of labor $L$. (15 points)

(c) Why do you think hours per worker and the ratio of employment to population are lower in France than in the US? Where would you rather work? Live? Eat? (5 points)

Data Source. GDP, Employment, and Population are from the Penn World Table (version 7.0). Capital is our estimate, based on data on investment from the PWT. Years of schooling is from the Barro–Lee Dataset. Hours is from the 2010 “OECD Employment Outlook”.
2. **Korea.** Over the last 50 years, Korea has been one of the most successful economies in the world. What are the sources of this success? Consider the following data:

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP Per Capita</th>
<th>Population</th>
<th>Capital</th>
<th>Labor</th>
<th>Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>1,782</td>
<td>24.784</td>
<td>56.930</td>
<td>7.333</td>
<td>4.34</td>
</tr>
<tr>
<td>2009</td>
<td>25,029</td>
<td>48.509</td>
<td>4,749.232</td>
<td>24.275</td>
<td>11.77</td>
</tr>
</tbody>
</table>

GDP per capita is expressed in 2005 US dollars. Population and employment are in millions of heads. Capital is in billions of dollars. Education is the average number of years of school completed among people older than 15.

(a) Compute the (average continuously compounded) growth rate of GDP per worker. (10 points)

(b) Use our growth accounting methodology to allocate growth in output per worker to TFP, capital per worker, and human capital. What factors are most important? (10 points)

(c) What is the growth rate of GDP per capita? How does it differ from growth in output per worker? Why? (10 points)

Data Source. GDP, Population, and Employment are from the PWT. Capital is our estimate, based on data on investment from the PWT. Years of schooling is from the Barro–Lee Dataset.

3. **China.** China’s remarkable economic growth and large population have created one of the world’s largest economies. In 2010, GDP in China was still smaller than US GDP, but growing twice as fast. How will China’s economy fare in the next 20 years or so? (Hint: answering this question is fun, as long as you use Excel or any other software package. Otherwise, it is tedious work.)

Assume it is January 1, 2011. Your mission is to use the Solow model to estimate economic growth in China up to 2030. Please download the spreadsheet `hw2.xls` It reports data for China’s population, GDP, capital stock, and educational achievement between 1975 and 2010.

Educational achievement is proxied by average years of schooling. Population is in thousand of individuals. GDP per capita, GDP per worker, and capital per capita are expressed in 2005 US dollars.

Assume that the production function is of the form $Y = AK^a( HL )^{1-a}$ and that the depreciation rate is 6% per year.

(a) Use the law of motion for the capital stock in order to obtain estimates of the saving rate in all years 1975–2009. (10 points)

(b) Assume that between 2011 and 2030, TFP, population, employment, and educational attainment will grow at the average rate for the period 1975–2010 and that the saving rate will be equal to the average saving rate for the
same period. Obtain estimates for GDP per capita up to 2030. Comment (briefly) on the strengths and weaknesses of your analysis. What parameter values are you least certain about? What features of the world does the model miss? (20 points)

(c) How would your forecast change if TFP did not grow at all over the period 2011–2030? How about the scenario in which educational attainment did not grow? Finally, what would happen if both population and employment stayed at the 2010 level throughout the period? (10 points)

Data Source. GDP, Population, and Employment are from the PWT. Capital is our estimate, based on data on investment from the PWT. Years of schooling is from the Barro–Lee Dataset.