Econ 1560 Final Exam

Instructions: Please answer all questions in the blue books. You may not use notes, books, or calculators. Please show your work. There are eight questions (some with multiple parts), for a total of 100 points. Questions vary in their level of difficulty. Partial credit will be given for partially correct answers. Good luck!

1) [5 points] Acemoglu and Robinson categorize institutions into two broad groups. What are the specific terms that they use to describe these groups?

2) [10 points] “If age specific fertility were to remain constant, a rise in life expectancy at birth from 40 to 60 would raise the NRR in a typical developing country by about 1.0. We would thus expect that, if fertility were to remain constant, a rise in life expectancy that was twice as large, from 40 to 80, would raise the NRR by roughly twice as much, that is, by roughly 2.0.”

Comment on this statement, either supporting it or arguing against it. Your answer should be a few paragraphs long, and should include appropriate diagrams.

3) [5 points] How does the perceived level of income mobility in a country affect the desired level of redistributive taxation? Be sure to both explain the direction of the effect (i.e. higher perceived mobility leads to less desired redistribution or to more desired redistribution) and also the channel through which this effect operates.

4) [15 points] A country is described by the Solow model, with investment rate of 20%, population growth rate (which is also the growth rate of the labor force) of 2%, and depreciation rate of 5%. The production function is

\[ Y = AK^\frac{1}{2}L^\frac{1}{2} \]

In the year 2010, the quantity of labor was 16, the capital stock was 1600, and the value of \( A \) was 10. What fraction of investment was used for each of the each of the following: replacing depreciated capital, supplying capital to match the increase in the labor force, and raising the amount of capital per worker?
5) [20 points] There are two countries in the world, labeled 1 and 2. They have equal sized populations. In each country, the production function in per worker terms is

\[ y = Ak^\alpha \]

The countries have equal rates of depreciation and population growth. There is no technological progress in either country. However, the level of productivity is higher in country 1 than in country 2, that is

\[ A_1 > A_2. \]

Factors of production (i.e. capital and labor) are not mobile between the two countries. Also, there is no trade between them. The two countries have equal levels of output per worker.

A. [10 points] Suddenly, the law is changed so that capital (but not labor) can flow freely between the two countries. In which direction will it flow? Explain your answer. [Note: you may not use the results from part B of this question to justify your answer to this part.]

B. [10 points] Carrying on the above scenario, suppose that we have \( A_1 = 2A_2 \) and \( \alpha = 0.5 \). Also, assume that capital is perfectly mobile, which is to say that it can be ripped out of the ground in one country and costlessly installed in the other country. Solve for the ratio of capital per worker in the two countries that we will observe once the capital movement has taken place.
6) [15 points] The table below shows the probability that the son of a father in a particular part of the income distribution (given by the row) will himself be in a particular part of the income distribution (given by the column). So, for example, the son of a man who is in the bottom half of the income distribution has a 20% chance being in the top half of the income distribution.

<table>
<thead>
<tr>
<th>Income of Father</th>
<th>Income of Son</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bottom half</td>
</tr>
<tr>
<td>Bottom half</td>
<td>.80</td>
</tr>
<tr>
<td>Top half</td>
<td>.20</td>
</tr>
</tbody>
</table>

In your bluebook, copy over and fill in the table below, which shows the relationship between the position in the income distribution of grandfathers (for rows) and grandsons (for columns).

<table>
<thead>
<tr>
<th>Income of Grandfather</th>
<th>Income of Grandson</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bottom half</td>
</tr>
<tr>
<td>Bottom half</td>
<td></td>
</tr>
<tr>
<td>Top half</td>
<td></td>
</tr>
</tbody>
</table>

Note: You should assume that women (i.e. mothers and grandmothers) play no role in this story.
7) [20 points] Consider the two-country model of technology. The equations are presented below, where I will save space by telling you that country 1 is the technology leader. Also, to make the math easier, I will assume that the labor forces in both countries are equal to one.

\[ y_1 = A_1 (1 - \gamma_{A,1}) \]
\[ y_2 = A_2 (1 - \gamma_{A,2}) \]
\[ \hat{A}_1 = \frac{\gamma_{A,1}}{\mu_i} \]
\[ \hat{A}_2 = \frac{\gamma_{A,2}}{\mu_c} \]
\[ \mu_c = \mu_i \left( \frac{A_2}{A_1} \right)^2 \]

Assume that the countries are in steady state (that is, their relative levels of technology are constant). The fractions of the labor force devoted to R&D are:

\[ \gamma_{A,1} = .60 \]
\[ \gamma_{A,2} = .15 \]

A) [10 points] Solve for the ratio of technology in country 1 to technology in country 2.

B) [10 points] Which country has higher output per worker? Show how you got your answer.
8) [10 points] Suppose that the Hotelling model of natural resource extraction is completely true in the case of oil. Specifically, the future path of oil prices is known exactly, and all oil producers plan their oil extraction as would be predicted by the Hotelling model, which is to say that they maximize the present value of their oil revenue net of extraction costs (and they all face the same rate of interest). Further, there are no problems with property rights for oil being unclear, such as when a pool of oil lies under two countries.

To make things easy, let’s assume that that all oil deposits have already been found and are ready to be extracted. Further, the cost of extraction (i.e. dollars per barrel to remove the oil from the ground) does not depend on the speed with which the oil is extracted. That is, any country or company can extract all the oil it wants from its deposits at any time.

Different oil deposits differ in their extraction costs. Some, such as those in Saudi Arabia, have low extraction costs. Others, such as the North Sea, have high costs. At any point in time, all oil sells for the same price regardless of the cost of extraction. Although the price of oil changes over time, extraction costs for any given deposit of oil do not.

What pattern do you expect to see in terms of the extraction cost of oil pumped at different times? Specifically, will low-extraction-cost deposits be pumped before high-extraction-cost deposits, or vice versa? Or is there no particular pattern predicted by theory?

You should back up your answer with a good explanation. The best way to do this is probably with a simple numerical example.