Instructions: Please answer all questions in the blue books. You may not use notes, books, or calculators. Please show your work. There are a total of 13 questions, for 100 points. Questions vary in their level of difficulty. Partial credit will be given for partially correct answers. Good luck!

1) [12 points] It has just been announced that large deposits of oil have been discovered in Chile. It will take five years for production to begin, but after that time Chile will become the world’s largest oil producer by a large margin.

A) [4 points] How and why does this announcement affect the world supply curve for oil in the period before Chile’s production comes on line?

B) [4 points] How and why does this announcement affect the world demand curve for oil in the period before Chile’s production comes on line?

C) [4 points] Based on your answers to parts A and B, what can you say about what will happen to the world price and quantity of oil consumed in the period before Chile’s production comes on line?

2) [12 points] Coffee is primarily made from two different beans, arabica and robusta. The beans grow in different countries.

Suppose that in the year 2008, a major scientific study finds that drinking coffee made from arabica beans contributes to heart disease, while drinking coffee made from robusta promotes better health. As a result, the price of arabica beans falls and price of robusta beans rises.

An economist reads about these goings on and says “Great. This will help me understand the connection between income and quality of government.” Explain her thinking, what data she would look at to carry out this investigation, and how she would interpret the results. Also explain why looking at this data would be superior to simply examining the correlation between income and the quality of government.
3) [5 points] The following figure shows data on GDP per capita in 1960 and the social capability index measured in the same year. Based on this figure as well as the findings reported in the book, but not on what you know about their subsequent growth performance, which country would you expect to have higher growth over the period 1960-2000, Thailand or Mexico? Explain briefly.

![Figure 14.3: Social Capability versus GDP per Capita 1960](image-url)

4) [10 points] The table below presents data on physical capital, human capital, and output in a country at two points in time, labeled Year 1 and Year 2.

<table>
<thead>
<tr>
<th></th>
<th>Output per worker</th>
<th>Physical capital per Worker</th>
<th>Human capital per Worker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>10</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>Year 2</td>
<td>40</td>
<td>40</td>
<td>10</td>
</tr>
</tbody>
</table>

The production function (in per worker terms) is

\[ y = Ak^{1/3}h^{2/3} \]

Over this period, which has been a more important source of growth in the country: human capital accumulation, physical capital accumulation, or productivity growth? Show how you got your answer. Note: you do not need to calculate annual growth rates to solve this question. You also do not need to know how far apart Year 1 and Year 2 are.
5) [10 points] The table below shows the probability that a mother in given part of the income distribution (given by the row) will have a daughter in a given part of the income distribution (given by the column). So, for example, the daughter of a woman with income in the bottom third of the income distribution will herself have a 60% chance of being in the bottom third, a 25% chance of being in the middle third, and a 15% chance of being in the top third.

<table>
<thead>
<tr>
<th>Income group of Mother</th>
<th>Income Group of Daughter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bottom third</td>
</tr>
<tr>
<td>Bottom third</td>
<td>.6</td>
</tr>
<tr>
<td>Middle third</td>
<td>.25</td>
</tr>
<tr>
<td>Top third</td>
<td>.15</td>
</tr>
</tbody>
</table>

What is the probability that the granddaughter (along the maternal line) of a woman in the middle third of the income distribution will herself be in the middle third of the income distribution? Show how you got your answer.

6) [7 points] “Devoting more resources to technology will raise the growth rate of productivity of a country in the short run. Whether doing this will raise the growth rate of productivity in the long run depends on …..” Complete this sentence and explain in 2 or 3 sentences.

7) [6 points] Consider the two country model of technology change. Country A is the technology leader and country B is the technology follower. The two countries are in steady state. Country B is 70 years behind country A in terms of technology. The level of technology in country A is twice the level of technology in country B. At what rate (approximately) is technology growing in country B? Show how you got your answer.
8) [12 points] Consider a country with fixed quantities of capital and labor. Call these $K_D$ and $L_D$ (the D is for “domestic”). The country has a standard production function with constant returns to scale (You may assume that the production function is Cobb-Douglas, but this is not required to answer the question). Factors are paid their marginal products. Initially, the economy is closed to the rest of the world.

Now suppose that a quantity of foreign capital is brought into the country. The quantity is $K_F$, so the total capital stock is now $K_D + K_F$. The quantity of labor does not change.

For all of the questions below, your answer should refer to the comparison of the time immediately before the addition of the foreign capital to the time immediately afterward. You should not worry about additional capital accumulation that would take place at later times.

A) [2 points] Does the addition of the extra capital cause the total quantity of output to rise, fall, or stay constant? Explain.

B) [2 points] Does the addition of the extra capital cause the earnings of domestic capital to rise, fall, or stay constant? Explain.

C) [2 points] Does the addition of the extra capital cause the earnings of labor to rise, fall, or stay constant? Explain.

D) [6 points] Does the addition of the extra capital cause the sum of earnings of labor plus earnings of domestic capital to rise, fall, or stay constant? Explain. [Hint: Draw the usual picture we use to analyze the production function, with capital on the horizontal axis and output on the vertical axis. Mark $K_D$ on the horizontal axis, and the corresponding level of output. Now mark $(K_D + K_F)$ on the horizontal axis and its corresponding level of output. Now draw a line with slope equal to the MPK when capital is equal to $(K_D + K_F)$. Graphically show the earnings of foreign capital. Subtract this from total output and you are left with the earnings of domestic capital plus labor.]

9) [2 points] Fill in the blank (report your answer in the blue book): _______ has been called “the great executioner of nature”

10) [2 points] Fill in both blanks: In the typical developing country, reducing the NRR to _____ will not reduce population growth to zero in the short run because of ______.
11) [5 points] In discussion the different experiences of China and Britain in industrialization, and particularly the role of coal, the textbook discusses two differences between Chinese and British coal deposits. The first difference is location: British coal deposits were located near pre-existing centers of industrial activity and also near water transport, while Chinese deposits were more remote from centers of economic activity and not easy accessed. The second difference involved the geology of the deposits themselves. What was it, and why was it (arguably) important as a reason why Britain started using coal-fired steam engines before China?

12) [5 points] Explain briefly what assortative mating is and how it affects the degree of intergenerational income mobility in a country.

13) [12 points] In the novel *The Children of Men* (now a major motion picture), humans suddenly lose the ability to have children. Consider how this would affect GDP per capita in a model in which output is produced solely by the labor of working age adults. Ignore the roles of capital, efficiency, natural resources etc. Assume that there is no technological progress. Assume that output per working age adult is constant. Assume that people start working at age 20, retire at age 60, and die at age 80.

Consider a country in which fertility has been constant at the replacement level for a long time. Suppose that fertility fell to zero in the year 2010 and stayed at that level permanently.

Sketch out and describe in as much detail as possible the path that GDP per capita would follow between 2010 and 2090, when the last person would die. In particular, let the vertical axis in your figure measure GDP per capita relative to the baseline of pre-2010. You should indicate (and figure out) the year in which GDP per capita peaks, and how its peak compares to the pre-2010 level. You should also figure out in which year GDP per capita returns to its pre-2010 level.