1. Consider a Ricardian model of comparative advantage. There are two countries, the U.S. and Mexico. Suppose each country can produce two goods, shirts (S) and corn (C). Furthermore, suppose that the US has 100 workers, while Mexico has 300 workers. Labor productivities in each country are given by the following table:

<table>
<thead>
<tr>
<th>Good</th>
<th>United States</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shirts</td>
<td>4 shirts/hour</td>
<td>2 shirts/hour</td>
</tr>
<tr>
<td>Corn</td>
<td>12 bushels/hour</td>
<td>1 bushel/hour</td>
</tr>
</tbody>
</table>

(a) Which country has the absolute advantage in shirts?; in corn? Explain.

(i) In which good does the US have a comparative advantage?; in which good does Mexico have a comparative advantage?

(b) Derive and sketch the production possibility frontier for each country.

(i) Assume that originally the U.S. produces and consumes 200 shirts and 600 bushels of corn, while Mexico produces and consumes 300 shirts and 150 bushels of corn. Show how, by changing production decisions in each country, it is possible to increase total world output of both goods and thus to increase (consumption and) welfare in each country.

(ii) Derive the world production possibility frontier (i.e., find the maximum possible output of shirts, for each level of output of corn).

(c) In the absence of trade, what would autarky (no trade) relative prices be in each country? What would the real wage be in each country?

(d) Assume all people have the same preferences, given by the following utility function:

\[ U = (D_c)(D_s) \]

where \( D_c, D_s \) represent consumption of goods C (corn) and S (shirts), respectively. Note that this utility function (these preferences) implies that individuals spend half of their income on each good, i.e., demands are:

\[ D_c = (I/2P_c); D_s = (I/2P_s) \]

where \( I \), personal income, would be the (nominal) wage in this model.

(i) Find the equilibrium world (relative) price of goods under free trade (i.e., set total world supply equal to total world demand and solve for price).

(ii) Show how the real wage (and utility) changes in each country due to free trade. Do both countries gain from free trade?

(e) Suppose the Mexican labor force increases to 600 workers. Show how this affects the equilibrium world price of goods and real wages in each country.

Finally, suppose labor productivities in the U.S. change so that:
Hourly Labor Productivity by Country and Good

<table>
<thead>
<tr>
<th></th>
<th>United States</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shirts</td>
<td>6 shirts/hour</td>
<td>2 shirts/hour</td>
</tr>
<tr>
<td>Corn</td>
<td>18 bushels/hour</td>
<td>1 bushel/hour</td>
</tr>
</tbody>
</table>

(f) Will this change in labor productivities in the U.S. affect autarky (no trade) prices in the U.S.? Will it affect the autarky U.S. real wage? Explain.

(g) What is the likely impact of this change in labor productivities on post-trade prices and the standard of living in each country?

(i) Given the demand curves from part (d), and the labor force levels from part (e), calculate the equilibrium world price using the new productivity levels. Compared to your earlier result (for part d), how does this change in US productivity affect: (1) the relative price of corn; (2) the real wage in the U.S. (the utility level); and (3) the real wage in Mexico?

2. To illustrate how the model can be extended to more than two countries, consider the following example

Hourly Labor Productivity by Country and Good

<table>
<thead>
<tr>
<th></th>
<th>Shirts</th>
<th>Corn</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>6 shirts/hour</td>
<td>12 bushels/hour</td>
</tr>
<tr>
<td>Mexico</td>
<td>2 shirts/hour</td>
<td>1 bushel/hour</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>6 shirts/hour</td>
<td>4 bushels/hour</td>
</tr>
<tr>
<td>United States</td>
<td>10 shirts/hour</td>
<td>15 bushels/hour</td>
</tr>
</tbody>
</table>

(a) Which country has an absolute advantage in shirts?; in corn?
(b) Compared to the UK, in which good does the US have a comparative advantage?
(c) Compared to France, in which good does the US have a comparative advantage?
(d) Find the autarky relative prices in each country.
(e) Find the world supply curve for shirts, assuming free trade.
(f) Sketch the world production possibility frontier.
(g) Under free trade, which good would each country export? Do you need information about demand, or country size, to determine the pattern of trade (exports) for each country? Explain.

3. To illustrate how the model can be extended to more than two goods, consider the following example

Hourly Labor Productivity by Country and Good

<table>
<thead>
<tr>
<th></th>
<th>Food</th>
<th>Clothing</th>
<th>TVs</th>
<th>CDs</th>
<th>Shoes</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>10</td>
<td>6 pants/day</td>
<td>3 TVs/day</td>
<td>4 CDs/day</td>
<td>6 shoes/day</td>
</tr>
<tr>
<td>Mexico</td>
<td>2 bushels/day</td>
<td>4 pants/day</td>
<td>1/2 TV/day</td>
<td>2 CDs/day</td>
<td>9 shoes/day</td>
</tr>
</tbody>
</table>

(a) In which good(s) does the U.S. have an absolute advantage? In which good(s) does Mexico have an absolute advantage?
(b) Does the U.S. have a comparative advantage in TVs? If so, explain why? Does the U.S. have a comparative advantage in CDs? If so, explain why? In what good(s) does Mexico have a comparative advantage?

(c) Find autarky relative prices in each country (for example, the price of each good in terms of shoes).

(d) If trade were allowed, what can you predict about the pattern of trade? (i.e., which goods the U.S. exports and which it imports)? Explain.

(e) Let W denote the wage in the U.S., and W* denote the Mexican wage (measured in the same units, e.g., dollars). Show where each good is produced based upon the ratio of wages between the two countries.

(f) Briefly discuss how an increase in the US labor supply will affect: (1) US real wages; (2) the set of goods the US exports; (3) the relative prices of goods; and (4) real wages.

4. EXTRA CREDIT (10 points). Use the model of question 3, and assume the initial labor force in the US is 100 and the initial labor force in Mexico is 30. Also, assume that each consumer spends (1/5) of his/her income on each good; i.e., the demands for each good are: \[ D_j = \left( \frac{1}{5} I \right) P_j \] for all \( j \)

where \( D_j \) is quantity demanded of good \( j \), \( I \) is income, and \( P_j \) is the price of good \( j \), and this holds for every good.

(a) Find the original equilibrium prices and wages.

(b) Suppose the Mexican labor force doubles to 60. Find the new equilibrium prices and wages and indicate how the labor force growth in Mexico affects US and Mexican welfare.

(c) Suppose that the Mexican labor force does not change (i.e., it remains at 30) but that Mexican labor productivity doubles in all goods. Find the new equilibrium prices and wages and compare to part b. How does the productivity increase in Mexico affect U.S. and Mexican welfare?

NOTE ON GRADING OF PROBLEM SETS:

As stated on the syllabus, problem sets will account for 25% of your grade. On each problem set, each problem will count 10 points. At the end of the year, I will add up the points you earned on the problem set, and the maximum number of points, and I will convert that to a percentage. Extra credit points will count in the numerator but not the denominator. The maximum you can earn on problem sets is 100%, which will count as 25% of your total grade.

Example 1: 15 required problems, 2 extra credit problems during year. You earn 115 on the required problems, and 15 on the extra credit problems. Your percent is: \( \frac{130}{150} \times 100 = 86.7\% \)

Example 2: 15 required problems, 2 extra credit problems during year. You earn 140 on the required problems, and 15 on the extra credit problems. Your percent is: \( \frac{155}{150} \times 100 = 100\% \).