Part I (32 points – 4 Questions)

1. According to the Rybczynski theorem, how will immigration of unskilled labor from Turkey to Germany affect the output of the labor-intensive good and the capital-intensive good in Germany and Turkey? (8pts)
   A decrease in Turkey's output of labor-intensive products and increase in capital-intensive output.
   A decrease in Germany's output of capital-intensive products and increase in labor-intensive output.

2. Studies have concluded that NAFTA caused a gain in economic welfare for Canada. List some of the reasons for Canada to join NAFTA. Has the United States gained or lost from NAFTA? Explain. (8pts)
   Canada: Increase in employment levels and increase in productivity
   US: Increase in unemployment and increase in product variety
   Gains in the US due to product variety are considered to be greater than the short-term loss due to increase in unemployment.

3. Consider an offshoring model of reverse FDI in which Foreign offshores skilled labor activities to Home because Home's skilled labor has a lower relative wage than Foreign's skilled labor relative wage. Also assume that the costs of capital and trade are uniform across production activities.
   a) Will Foreign's offshored production activities be high or low on the value chain for a given product? (2pts)
      Foreign's offshored production will be high on the value chain because activities higher on the value chain require more skilled labor than activities lower on the value chain.
   b) Suppose that Foreign uniformly increases its tariff level, effectively increasing the cost of importing all goods and services from abroad. How does this affect the slicing of the value chain? How will an increase in a government subsidy on production of goods in Foreign affect the slicing of the value chain? (4pts)
      If Foreign increases tariffs on imports, the cost of the offshored production returned to Home will increase, i.e., trade costs will rise, and it will be less likely that Home will continue to offshore.
      The subsidy will distort the production in favor of Foreign, similar to the rise in trade costs.
   c) How would a firm with large research and development costs benefit from free trade? (2pts)
      High-fixed-cost firms desire to spread those costs across more consumers in order to increase profits.
4. a) Explain why the exporting foreign country will always lose when a large home country imposes a tariff.(4pts)
   The exporting foreign country always loses producer surplus as a result of the tariff. This is lost because it sells fewer goods to the large tariff-imposing country at a lower price. The terms-of-trade gain to the importing country is an equivalent terms-of-trade loss for the exporting country. In addition, the tariff imposes a further deadweight loss from reduced production at a lower price.

b) List two effects of an import tariff. (2pts)
   Increase in price levels, creates deadweight losses, increases producer surplus and decreases consumer surplus, increases revenue for the government

c) As taught in this course, what is the WTO acronym for? (2pts)
   World Trade Organization

Part II – (48 points – 6 Questions)
1. China has 2000 units of capital and 2000 workers while France has 6,000 units of capital and 4,000 workers. Clothing production is labor intensive and chemical production is capital intensive. Suppose that France eliminates all restrictions on immigration from China. How many workers must emigrate to France in order for factor price equalization to occur? (4 pts)

Factor price equalization requires that the Capital/Labor ratio be equalized across the two countries. Since

<table>
<thead>
<tr>
<th></th>
<th>Capital</th>
<th>Labor</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>France</td>
<td>6,000</td>
<td>4,000</td>
</tr>
</tbody>
</table>

and K_C/L_C = 1 while K_F/L_F = 3/2, we need to solve K_C/(L_C - ΔL_C) = K_F/(L_F + ΔL_C). Substituting from the table above, 2000/(2000 - ΔL_C) = 6000/(4000 + ΔL_C). Solving for ΔL_C gives 8000 + 2 ΔL_C = 12000 - 6 ΔL_C, or 8 ΔL_C = 4000, and ΔL_C = 500

2. A monopolistically competitive firm faces demand given by P=100-10Q. It has no fixed costs and the marginal cost is $20 per unit.
   a) What quantity will this firm produce when it is maximizing its profits? (3 pts)
   The firm will maximize profits when marginal revenue (MR) equals marginal cost (MC). To derive the MR curve, multiply the demand curve by Q to get total revenue and take the derivative with respect to Q, i.e., TR = PQ = (100 - 10Q) × Q = 100Q - 10Q^2 and dTR/dQ = 100 - 20Q. Setting MC ($20) equal to MR (100 - 20Q) yields 20Q = 80 and Q = 4.

   b) What price will the firm charge when it is maximizing its profits? (3 pts)
   Substitute Q = 4 into the demand equation to get a price of P = 100 - 10 × 4 = $60.

   c) What is the value of the firm’s monopoly profits when it sets a price that maximizes its monopoly profits? (3 pts)
   At the price of $60 and quantity of 4, its total revenue is $240 and its total cost is 4 × $20 = $80. It is earning monopoly profits of $160.
d) What will happen to the firm’s profits, price and quantity in the long run?(3 pts)
Its price will fall, its output may fall or rise, depending upon the change in its
demand curve as more firms enter its market, and its monopoly profits will
disappear.

3. The table below gives intra-industry trade in three industries, A, B, and C.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Exports</th>
<th>Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>300</td>
<td>200</td>
</tr>
<tr>
<td>B</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>C</td>
<td>400</td>
<td>600</td>
</tr>
</tbody>
</table>

a) Calculate the intra-industry trade index for each industry. (6pts)
The intra-industry trade index is \( \frac{\text{min(imports, exports)}}{\frac{1}{2} \text{(imports + exports)}} \)
For Industry A: \( \frac{\text{min}(200,300)}{\frac{1}{2}(200 + 300)} \) = \( \frac{200}{250} = 0.8 \)
For Industry B: \( \frac{\text{min}(500,500)}{\frac{1}{2}(500 + 500)} \) = \( \frac{500}{500} = 1.0 \)
For Industry C: \( \frac{\text{min}(600,400)}{\frac{1}{2}(600 + 400)} \) = \( \frac{400}{500} = 0.8 \)

b) Which of the three industries has the greatest degree of intra-industry trade? (2pts)
From part (a), Industry B

4.

a) In a “no-offshoring” equilibrium, how many units of component production and R&D production will occur? (2pts)
120 components, 80 R&D.

b) Assuming skilled workers are needed for R&D and unskilled workers are needed for components. Describe the effect an increase in the price for R&D products will have on their exports, the demand for skilled workers and the price line. (3pts)
An increase in the price for R&D products will increase the R&D exports, increase the demand for skilled workers and flatten the price line.

c) What are the firm’s benefits if the price of component parts becomes relatively cheaper abroad? (In terms of producing and trading R&D and component production) (3pts)
If the price of component parts becomes relatively cheaper abroad there will be an increase in imports of components and increase in exports of R&D.
5. **Table: Distances and GDP**

<table>
<thead>
<tr>
<th>Country</th>
<th>Distance from the United States</th>
<th>GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>4,000 miles</td>
<td>$4 trillion</td>
</tr>
<tr>
<td>Norway</td>
<td>5,000 miles</td>
<td>$0.5 trillion</td>
</tr>
<tr>
<td>France</td>
<td>3,000 miles</td>
<td>$2 trillion</td>
</tr>
<tr>
<td>Sweden</td>
<td>5,500 miles</td>
<td>$1 trillion</td>
</tr>
</tbody>
</table>

Assume that the formula for trade using the gravity equation is:

\[
\text{Trade}_{12} = B \cdot \frac{GDP_1 \cdot GDP_2}{\text{dist}}
\]

Where \( B \) is a constant, \( GDP_1 \) is GDP of US and \( GDP_2 \) is GDP of partner country and \( \text{dist} \) is the distance between US and partner country.

a) According to the gravity equation, what country should be the largest trading partner of the United States? (2pts)

Holding \( B \) and \( GDP_2 \) constant, Germany is \( \frac{4.0T/4000}{4000} = \frac{1}{4000} \cdot 4.0T = 1B \), Norway is \( \frac{0.5T/5000}{5000} = \frac{1}{5000} \cdot 0.5T = 0.1B \), France is \( \frac{2T/3000}{3000} = \frac{1}{3000} \cdot 2T = 0.67B \) and Sweden is \( \frac{1T/5500}{5500} = \frac{1}{5500} \cdot 1T = 0.18B \). Germany is the largest at \( 1B \).

b) According to the gravity equation, what country should be the smallest trading partner of the United States? (2pts)

Norway is the smallest at \( 0.1B \).

c) Use this information to answer the following questions: The GDPs of countries A, B, and C are $1,000, $2,000, and $3,000, respectively. There are 1,000 miles between country A and countries B and C. Assume that their markets are monopolistically competitive. Does the gravity equation predict that there will be more trade between A and B or between A and C? Please show your calculations. (4pts)

<table>
<thead>
<tr>
<th>Country</th>
<th>GDP</th>
<th>Distance from A</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>$2,000</td>
<td>1,000</td>
</tr>
<tr>
<td>C</td>
<td>$3,000</td>
<td>1,000</td>
</tr>
</tbody>
</table>

Since the distances are the same, the country with the higher GDP will have more trade. A and C
6.

a) How much is the tariff in the home market? (1 pt)
\[ P^W + t - P^W = $22 - $16 = $6 \]

b) Under free trade, how many units will the home market import? (1pt)
Demand will be 26 and supply will be 10, so the imports will be 16

c) After the imposition of the tariff, how much is the increase in producer surplus in the home market? (2pts)
The increase in producer surplus in the home is the area between \( P^W + t \), \( P^W \) and the Supply line. Calculate this area as \((6 \times 14) - \frac{1}{2}(6 \times 4) = 72\)

d) What is the government revenue due to the tariff in the home market? (2pts)
Government revenue is the tariff times the number of units imported under the tariff, \( 6 \times 8 = $48 \)

e) What is the deadweight loss in the home market? (2pts)
The deadweight loss in the home market is the area of the two triangles that are \( 6 \times 4 = 24 \)
Part III – (20 points – 2 Questions)

1. Consider an offshoring model in which the hours of labor used in two activities in Germany and China are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Assembly</th>
<th>R&amp;D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Skilled Labor</td>
<td>Germany: 5, China: 20</td>
<td>Germany: 1, China: 4</td>
</tr>
<tr>
<td>High Skilled Labor</td>
<td>Germany: 1, China: 4</td>
<td>Germany: 10, China: 40</td>
</tr>
</tbody>
</table>

The High-Skilled/Low-Skilled ratio for Assembly is 1/5 and for R&D is 10/1.

<table>
<thead>
<tr>
<th>Wages paid per hour</th>
<th>High-Skilled</th>
<th>Low-Skilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>$50</td>
<td>$20</td>
</tr>
<tr>
<td>China</td>
<td>$10</td>
<td>$2</td>
</tr>
</tbody>
</table>

a) Compute the costs of production of each activity in each country when trade costs are 25% and 50% respectively for offshoring to China. (6 pts)

<table>
<thead>
<tr>
<th></th>
<th>Assembly</th>
<th>R&amp;D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Production</td>
<td>Germany: $150, China: $80</td>
<td>Germany: $520, China: $408</td>
</tr>
<tr>
<td>Plus Trade Costs: 25%</td>
<td>Germany: $150, China: $100</td>
<td>Germany: $520, China: $510</td>
</tr>
<tr>
<td>Plus Trade Costs: 50%</td>
<td>Germany: $150, China: $120</td>
<td>Germany: $520, China: $612</td>
</tr>
</tbody>
</table>

b) With trade costs 25% and 50%, where is the value chain sliced? (2pts)
   - At 25% China will produce both
   - At 50% Germany does R&D and China does assembly

c) List some other costs that would affect the slicing of the value chain. (2pts)
   - Infrastructure costs, capital costs, higher utility costs

2. Suppose that the free-trade price of a ton of steel is €500. (Note: € is the symbol for the euro, a common currency used in 16 European countries, including Belgium. Belgium, a small country, imposes a €80 per-ton specific tariff on imported steel. With the tariff, Belgium produces 300,000 tons of steel and consumes 600,000 tons of steel.

   a) What is the purpose of this €80-per-ton tariff? (2pts)
      - To protect Belgian steel producers from foreign competitors

   b) What is likely to happen to Belgian production of steel and the price of steel sold in Belgium after the €80-per-ton tariff is imposed? (2pts)
      - Production of steel and price of steel both increase
c) Who will gain and who will lose as a result Belgium's €80-per-ton tariff on imported steel? (3pts)
Producers gain, consumers lose.

d) Suppose that the €80-per-ton tariff caused Belgian production of steel to increase by 100,000 tons and Belgian consumption of steel to fall by 100,000 tons. What is the value of Belgium's welfare loss due to the tariff? (3pts)
At €80-per-ton and a fall of 100,000 tons, the welfare loss is €80-per-ton times 100,000 tons or 8 million euros.