Midterm Exam 1
Answer key

Instructions: Read through the entire exam before you start writing. Pay careful attention to the number of points allocated to each question and use the points to allocate your time. Please make your answers clear, concise, and complete. Use graphs where you can; graphs are useful for illustrating and explaining your answer. The exam has a total of 100 points.

1. (25 points). Assume two countries, Italy and US, produce only cars and washing machines. Also assume that labor is the only factor of production and labor force is 1200 in each country. In Italy, an automobile can be produced by 5 workers in one day and a washing machine by 2 workers in one day. In the United States, an automobile can be produced by 4 workers in one day, and a washing machine by 1 worker in one day.

   a. Which country has an absolute advantage? Explain

   *US has an absolute advantage in producing both cars and washing machines. That is US can produce 1 car with fewer units of labor than Italy, and the same for washing machines.*

   b. Draw the PPF for both US and Italy with cars on the horizontal axis and washing machines on the vertical axis. Suppose that without trade Italy produces and consumes 110 cars and 325 washing machines and US produces and consumes 100 cars and 800 washing machines. Mark these points on your diagram. Which country has a comparative advantage in the production of cars? In washing machines? Explain your answer.

   ![Graph of Production Possibility Frontier (PPF)](image)

   *From the labor requirements, opportunity cost can be calculated:*
When US produces 1 car, it could have produced washing machines instead. Those 4 foregone washing machines are US’s opportunity cost of producing 1 car. Note that the opportunity cost (in terms of washing machines) of producing 1 car can be calculated by dividing the labor required to make 1 car by the labor required to make 1 washing machine. If the 4 units of labor required to make 1 car were instead allocated to washing machines production, then those 4 units of labor would produce 4 washing machines.

US has a comparative advantage only in the production of washing machines, and Italy has a comparative advantage in the production of cars. The opportunity cost of producing one washing machine in US is 1/4 of a car, which is lower than the 2/5 of a car than Italy has to forgo to produce 1 washing machine. Similarly, the opportunity cost of producing 1 car in Italy is 5/2 washing machines which is lower than the 4 washing machines US has to forgo to produce one car.

Each country has a comparative advantage in the good that it can produce at a lower opportunity cost than the other country, by definition. Note that if a country has a comparative advantage in some good, this does not necessarily mean that the country can produce this good more cheaply in terms of the input (in this exercise, labor) than the other country. For example, Italy has a comparative advantage in making cars even though it requires more labor to produce a car than in the US (i.e. even though US has an absolute advantage in making cars).

c. Now suppose that each country specializes in the good in which it has a comparative advantage, so that Italy produces 240 cars and US produces 1200 washing machines. They agree on a price between their opportunity costs (more than 2/5 washing machines per car, less than 4 washing machines per car), and trade goods at that price. Suppose a price of 3 washing machines per car.

Suppose that Italy trades 120 of its 240 cars for 360 of US 1200 washing machines. What are Italy and US production and consumption of cars and washing machines with trade? What are the gains from trade?

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>Italy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cars</td>
<td>WMs</td>
</tr>
<tr>
<td>In Autarky</td>
<td>Production</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Consumption</td>
<td>100</td>
</tr>
<tr>
<td>With Trade</td>
<td>Production</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Consumption</td>
<td>120</td>
</tr>
<tr>
<td>Gains from trade</td>
<td>+20</td>
<td>+40</td>
</tr>
</tbody>
</table>

Total gains from trade: 30 cars and 70 washing machines.

2. (15 points). According with the Australian Wool Innovation, severe drought conditions in Australia contributed to the lowest level of wool production in 50 years.
This record low production has driven up prices sharply in Australian wool markets. Meanwhile, the price of raw cotton increased significantly for the first time in many years.

a. Illustrate this observation with one demand and supply graph for the market for Australian wool and another demand and supply graph for the raw cotton.

b. Make sure that your graphs clearly show (1) the initial equilibrium before the decrease in the supply of Australian wool and (2) the final equilibrium.

c. Use arrows to indicate any shifts in the demand and supply curves for each market.

d. Label your graphs fully and write an explanation of your work.

Before the drought, the wool market was at equilibrium $E_1$ with equilibrium price at $P_1$ and equilibrium quantity at $Q_1$. Bad weather caused a drop in the production of wool. The supply of wool decreased, shifting the supply curve upwards from $S_1$ to $S_2$. The market for wool is at new equilibrium $E_2$, price increases from $P_1$ to $P_2$ and quantity supplied decreases from $Q_1$ to $Q_2$.

Cotton and Wool are substitutes. With a higher price in the wool’s market, some consumers would switch to raw cotton. When the price of a substitute increases, the demand for the other good increases. The demand for raw cotton increases. That is, the demand curve shifts to the left. Equilibrium moves from $E1$ to $E2$, price increases from $P1$ to $P2$, and quantity demanded of cotton increases from $Q1$ to $Q2$. 

4.
3. (20 points). A simple economy produces only four goods, pizza, spaghetti, cookies, and salad. The table below shows production and prices of the four goods 2008 and 2009.

<table>
<thead>
<tr>
<th></th>
<th>Gino’s pizza</th>
<th>Bruno’s spaghetti</th>
<th>Carlo’s cookies</th>
<th>Aldo’s salad</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008 units of output</td>
<td>4,000</td>
<td>3,000</td>
<td>2,000</td>
<td>5,000</td>
</tr>
<tr>
<td>2008 price per unit</td>
<td>$10</td>
<td>$9</td>
<td>$6</td>
<td>$7</td>
</tr>
<tr>
<td>2009 units of output</td>
<td>4,000</td>
<td>1,000</td>
<td>1,000</td>
<td>2,000</td>
</tr>
<tr>
<td>2009 price per unit</td>
<td>$8</td>
<td>$6</td>
<td>$1</td>
<td>$4</td>
</tr>
</tbody>
</table>


Nominal GDP 2008 = Prices in 2008 * Quantities in 2008
= 10*4,000 + 9*3,000 + 6*2,000 + 7*5,000 = $114,000

Nominal GDP 2009 = Prices in 2009 * Quantities in 2009
= 8*4,000 + 6*1,000 + 1*1000 + 4*2,000 = $47,000


Real GDP 2008 = Prices in 2009 * Quantities in 2008
= 8*4,000 + 6*3,000 + 1*2000 + 4*5,000 = $72,000

Real GDP 2009 = Nominal GDP 2009 = 47,000

c. Considering 2008 as the base year, given that total population was 1,140 in 2008 and 1,300 in 2009, what is the GDP per capita in 2008?

GDP per capita = GDP/Total population

GDP per capita in 2008 = $114,000/1,140 = $100

d. What is the rate of growth of nominal GDP between 2008 and 2009? What is the rate of growth of real GDP between 2008 and 2009 (base year 2009)?

Growth Nominal GDP = [($47,000-$114,000)/$114,000]*100 = -58.8%

Growth Real GDP = [($47,000-$72,000)/$72,000]*100 = -34.7%

4. (15 points). In an economy, the working age population is 100 million. Of this total,

80 million workers are employed
4 million workers are unemployed
16 million workers are not available for work (homemakers, students, etc.)
3 million workers are available for work but are discouraged and not seeking work.
2 million workers are available for work but are not seeking it due to child care problems, transportation issues, etc.

a. The labor force participation in this economy is ______84%____________.
Labor Force = employment + unemployment; LFP = \[ \frac{\text{Labor Force}}{\text{Pop} \cdot \text{age} \cdot 16 \cdot \text{or} \cdot \text{older}} \]

(84/100)*100 = 84%

b. The unemployment rate in this economy is ____4.76%____.

\[ \text{unemployment} = \frac{\text{Unemployed}}{\text{Labor Force}} \times 100 = \frac{4}{84} \times 100 = 4.76\% \]

c. What would happen to the unemployment rate if the military were included in the labor force?

Adding the military personnel to the labor force would decrease the unemployment rate. See the definition of unemployment rate.

5. (10 points). A country currently has a growth rate of 2.5%

a) Using the rule of 70, how many years approximately will it take the country to double GDP?

\[ \text{Rule of 70: # of years it takes GDP to double} = \frac{70}{\text{GDP growth rate}} = \frac{70}{2.5} = 28 \text{ years} \]

b) If the country wanted to decrease that number by five years, again use the rule of 70, what would the annual growth have to be?

\[ 23 \text{ years} = \frac{70}{\text{GDP growth rate}} = 3.04 \]

6. (15). State whether the claim in the statement below is true or false and explain why. You must provide and explanation to receive any credit.

If the amount of physical capital per worker grows, but the level of human capital per worker and technology are unchanged the growth rate of productivity keep rising at the same pace.

The statement is false. Productivity exhibits diminishing returns to physical capital. The accompanying figure illustrates this.
1. The increase in real GDP per worker becomes smaller...

2. ...as physical capital per worker rises.