**PRACTICE PROBLEMS 1 – ECON 3311 – Spring 2025**

1. **Suppose the following table represents the prices and quantities of computers and apples in two different years:**

| Year | $P_{computers}$ | $Q_{computers}$ | $P_{apples}$ | $Q_{apples}$ |
|---|---|---|---|---|
| 2010 | 1000 | 500 | 2 | 20,000 |
| 2022 | 1200 | 700 | 3 | 22,000 |

**Compute the overall percent change in GDP using 2010 as the base year and then using 2022 as the base year. Are the differences large using the two measures? Briefly explain why or why not.**

Nominal GDP in 2010: (1000*500) + (2*20,000) = 540,000
Nominal GDP in 2022: (1200*700) + (3*22,000) = 906,000

Real GDP using 2010 prices:
Real GDP 2010: 540,000
Real GDP 2022: (1000*700) + (2*22,000) = 744,000

$$growth = \frac{744{,}000 - 540{,}000}{540{,}000} = 0.377 = 37.7\%$$

Real GDP using 2022 prices:
Real GDP 2010: (1200*500) + (3*20,000) = 660,000
Real GDP 2022: 906,000

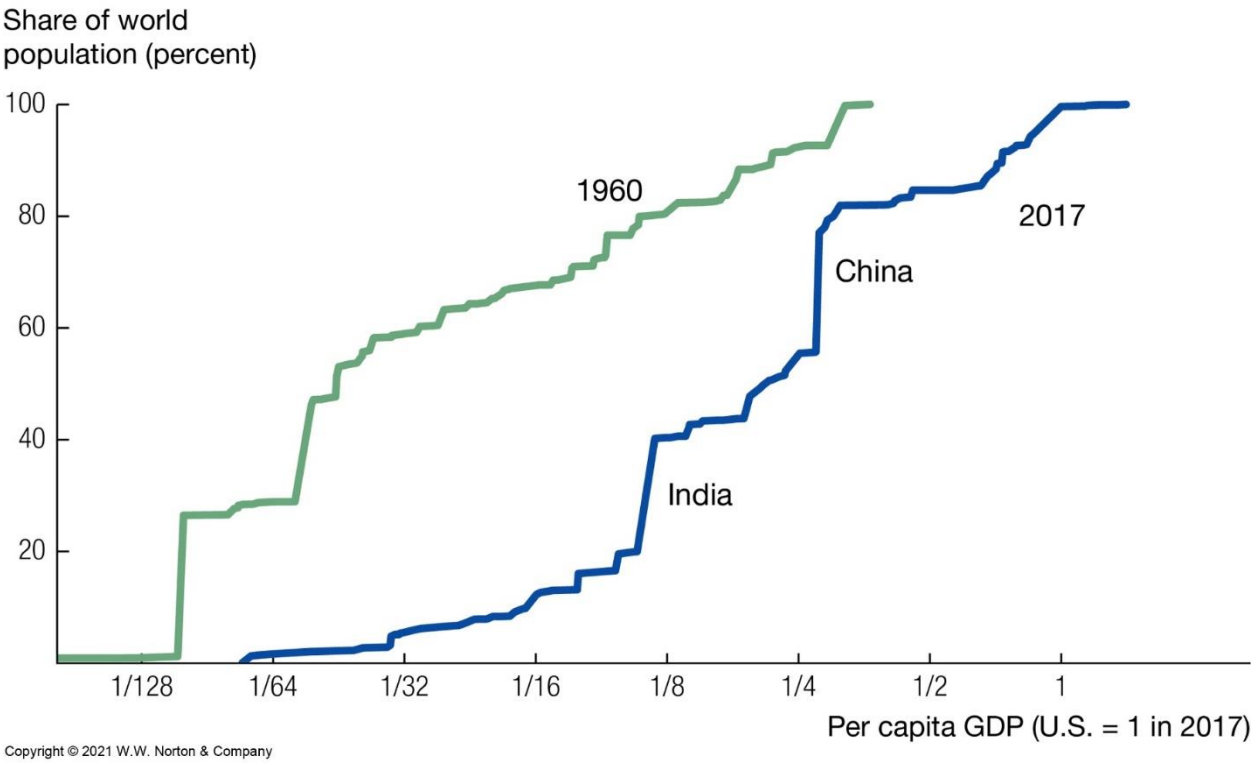
$$growth = \frac{906{,}000 - 660{,}000}{660{,}000} = 0.373 = 37.3\%$$

The GDP growth rates using the two different base years are about the same because there is not that large of a change in relative prices and the quantities consumed of the two goods.
Only when there is a drastic change in the relative prices of the goods and the relative quantities consumed will there be a large difference in using the two different indexes.

2. **Why is the consumer price index (CPI) not an accurate measure of the price changes faced by any <u>one</u> particular individual? Briefly explain.**

The CPI is based on a representative consumer. Our individual consumption habits are probably not exactly like the weights used by the CPI. For instance, if you do not drive, then you are probably not affected much by gas prices. On the other hand, you are affected more by changes in the price of public transportation.

**3. We went over the following graph is class:**





**a. In general, what happened between 1960 and 2017? Briefly explain.**

Overall GDP per capita has clearly increased around the world as can be seen by the blue line being further along the horizontal axis measuring per capita GDP than the green line. For instance, If we look at the GDP per capita of the median country, it was between 1/64 and 1/32 of US GDP per capita in 1960, and it was about ¼ of US GDP per capita in 2017.

**b. Did only low-income countries improve their GDP per capita between 1960 and 2017 or did higher-income countries increase their GDP per capita as well?**

Higher income countries improved their GDP per capita significantly as well. For instance, the highest income countries had a GDP per capita in 1960 that was between ¼ and ½ GDP per capita of the US in 2017. In 2017, several countries had GDP per capita that was higher than the US in 2017.

4. **We found in our calculations that the marginal product of capital is negatively correlated with K, but positively correlated with Y. What is a brief explanation for this?**

   The marginal product of capital is negatively correlated with K because of decreasing marginal product. As the number of capital units increases, each additional unit of capital adds less and less to overall output. One reason for this may be that with more and more capital there are fewer units of capital per worker.

   The marginal product of capital is positively correlated with Y because Y includes labor. The more units of labor there are, the more labor is available to work on newly available units of capital and the more output will increase.

5. **What is the difference between the marginal product of labor/capital and the returns to scale of the production function? Briefly explain.**

   The marginal product of labor and marginal product of capital depict the change in production when changing either capital or labor, while holding the other factor constant. Returns to scale refers to the relationship between changes in capital and labor by the same ratio and whether output changes by more than that ratio, equal to that ratio, or less than that ratio. For instance, if capital and labor increase by 10%, does output increase by more than 10%, exactly 10%, or less than 10%.

6. **Suppose that over a certain time period, the growth rate of GDP per capita was -3% and the growth rate of the population was 3%. What can we determine was the growth rate of GDP over this time period? Show your work.**

   Because GDP per capita is equal to GDP/population, the growth rate of GDP per capita is equal to the growth rate of GDP minus the growth rate of the population:

$$GDP_{capita} = \frac{GDP}{Population} \rightarrow g_{GDP/capita} = g_{GDP} - g_{pop} \rightarrow -3 = g_{GDP} - 3 \rightarrow \boldsymbol{g_{GDP} = 0}$$

   Given the information above, GDP did not change.

7. **Suppose that the marginal product of capital in a particular economy is:**

$$\boldsymbol{MPK = \frac{1}{3}\frac{Y}{K}}$$

   **If the production function displays constant returns to scale, what is the production function (assume *A = 1*)?**

   There are several ways to answer this question. One is that the MPK is equal to r. Then we can solve for r*K and find that it is one-fourth of Y. If one-fourth of income goes to

capital (K), then three-fourths of income goes to labor (L). These ratios also represent the exponents on the Cobb-Douglas production function.

$$Y = K^{1/3}L^{2/3}$$

**8. When calculating GDP using the expenditure approach, why are imports deducted? Briefly explain.**

When calculating GDP, we are interested in calculating only the goods and services produced within the borders of a country over a given time period. However, when we calculate the expenditure on consumption, we do not distinguish between those goods produced domestically and those goods produced overseas.
Suppose that part of consumption is $1 million worth of shirts purchased from India. If this $1 million is not subtracted through imports, then US GDP will be overstated by $1 million.
If, when calculating the different categories of GDP, only domestically produced goods were included, then we would not need to deduct imports because none were included in the first place.

**9. Suppose that the GDP of France grew by a constant rate from 1989 to 2024. If GDP grew from $1 trillion to $2.95 trillion, what was the growth rate over this time period? Does your answer make sense given the rule of 70? Briefly explain.**

We can use the following formula, plugging in the values $y_t = 2.95$, $y_0 = 1$, and $t = 30$:

$$y_t = y_0(1+\bar{g})^t \rightarrow 2.95 = 1 * (1+\bar{g})^{35} \rightarrow 2.95 = (1+\bar{g})^{35} \rightarrow (2.95)^{1/35} = 1+\bar{g}$$

$$1.0314 = 1+\bar{g} \rightarrow \bar{g} = 0.0314 \rightarrow \bar{g} = 3.14\%$$

Yes, the answer does make sense given the rule of 70. The rule of 70 states that GDP should double in approximately 70/g years (where g is measured in percent terms). Over the course of 35 years, GDP should double if the growth rate is about 70/g = 35, or g = 2. Because GDP more than doubled, then the growth rate should be greater than 2, which is what was found.

**10. Suppose that a production function of the form we used in class displays decreasing returns to scale. If the amount of capital doubles and the amount of labor increases by 50%, which of the following statements is true:**

**a. Output decreases**
**b. Output may double if the exponent on capital is much greater than that on labor**
**c. Output increases, but less than doubles**

If the production function displays decreasing returns to scale, then we can be certain that output will increase by less than the proportional increase in capital and labor. If capital and labor were to double, then output would less than double.
'a' is not correct because output must increase if capital and/or labor increase
'b' is not correct because output less than doubles
'c' is correct