1) Suppose that you have the following data for company XYZ:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Production</td>
<td>$450M</td>
</tr>
<tr>
<td>Material Expenses</td>
<td>$250M</td>
</tr>
<tr>
<td>Labor Costs</td>
<td>$100M</td>
</tr>
<tr>
<td>Capital Investment Expenditures</td>
<td>$150M</td>
</tr>
<tr>
<td>Depreciation Expenses</td>
<td>$5M</td>
</tr>
<tr>
<td>Change in Inventories</td>
<td>$70M</td>
</tr>
</tbody>
</table>

Calculate Company XYZ’s total contribution to US GDP.

\[
GDP = Total\ Production - Materials\ Expenses + Capital\ Investment + Change\ in\ Inventories = $450 - $250 + $150 + $70 = $420M
\]

2) Suppose you have the following data on an economy (assume that depreciation is equal to zero):

- Gross Domestic Product: $5,000
- Government Purchases: $2,000
- Tax Revenues: $500
- Net Exports: -$1,000
- Net Factor Payments: $200
- Depreciation: $400
- Consumption Expenditures: $3,000


First, we can convert GDP (gross domestic product) to GNP (gross national product) by adding net factor payments:

\[
GNP = $5,000 + $200 = $5,200
\]

Now, to get National Income, we subtract depreciation

\[
National\ Income = $5,200 - $400 = $4,800
\]

The current account is given by net exports plus net factor payments:

\[
Current\ Account = -$1,000 + $200 = -$800.
\]
Personal savings equals national income minus taxes minus consumption:

\[ \text{Personal Savings} = 4,800 - 500 - 3,000 = 1,300 \]

Gross savings is GNP – Consumption - Government

\[ \text{Gross Savings} = 5,200 - 3,000 - 2,000 = 200 \]

Gross Savings equals Gross Investment + Current Account

\[ 200 = \text{Gross I} - 800 \]

Solving for I, we get

\[ \text{Gross Investment} = 1,000 \]

Net Investment is Gross Investment minus depreciation

\[ \text{Net Investment} = 1,000 - 400 = 600 \]

The Government Deficit is Government Spending minus Taxes

\[ \text{Government Deficit} = 2,000 - 500 = 1,500 \]

3) Suppose that you have the following price data:

<table>
<thead>
<tr>
<th>Year</th>
<th>Apples ($/lb.)</th>
<th>Oranges ($/lb.)</th>
<th>Bananas ($/lb.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>$2.00</td>
<td>$3.50</td>
<td>$1.75</td>
</tr>
<tr>
<td>2011</td>
<td>$2.50</td>
<td>$3.60</td>
<td>$1.95</td>
</tr>
<tr>
<td>2012</td>
<td>$2.75</td>
<td>$3.90</td>
<td>$2.25</td>
</tr>
<tr>
<td>2013</td>
<td>$3.10</td>
<td>$4.25</td>
<td>$2.40</td>
</tr>
</tbody>
</table>

a) Using 2011 as your base year, calculate a price (CPI) assuming that the average household spent 30% of their income on apples, 50% on oranges, and 20% on bananas in the base year.

\[
2010: \ P = 0.30 \left( \frac{2.00}{2.50} \right) + 0.50 \left( \frac{3.50}{3.60} \right) + 0.20 \left( \frac{1.75}{1.95} \right) = 0.91
\]

\[
2011: \ P = 0.30 \left( \frac{2.50}{2.50} \right) + 0.50 \left( \frac{3.60}{3.60} \right) + 0.20 \left( \frac{1.95}{1.95} \right) = 1.00
\]

\[
2012: \ P = 0.30 \left( \frac{2.75}{2.50} \right) + 0.50 \left( \frac{3.90}{3.60} \right) + 0.20 \left( \frac{2.25}{1.95} \right) = 1.10
\]

\[
2013: \ P = 0.30 \left( \frac{3.10}{2.50} \right) + 0.50 \left( \frac{4.25}{3.60} \right) + 0.20 \left( \frac{2.40}{1.95} \right) = 1.21
\]
b) Calculate the annual inflation rate using your constructed CPI.

\[
\begin{align*}
2010 - 2011: & \quad \pi = \left[ \ln (1.00) - \ln (.91) \right] \times 100 = 9.92% \\
2011-2012: & \quad \pi = \left[ \ln (1.10) - \ln (1.00) \right] \times 100 = 9.75% \\
2012-2013: & \quad \pi = \left[ \ln (1.21) - \ln (1.10) \right] \times 100 = 9.18%
\end{align*}
\]

4) Consider the following production data

<table>
<thead>
<tr>
<th>Year</th>
<th>Apples (lbs.)</th>
<th>Oranges (lbs.)</th>
<th>Bananas (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>300</td>
<td>270</td>
<td>400</td>
</tr>
<tr>
<td>2011</td>
<td>320</td>
<td>260</td>
<td>410</td>
</tr>
<tr>
<td>2012</td>
<td>350</td>
<td>290</td>
<td>460</td>
</tr>
<tr>
<td>2013</td>
<td>360</td>
<td>310</td>
<td>480</td>
</tr>
</tbody>
</table>

a) Calculate nominal GDP for each year.

\[
\begin{align*}
2010: & \quad GDP = 2.00(300) + 3.50(270) + 1.75(400) = 2,245 \\
2011: & \quad GDP = 2.50(320) + 3.60(260) + 1.95(410) = 2,535.50 \\
2012: & \quad GDP = 2.75(350) + 3.90(290) + 2.25(460) = 3,128.50 \\
2013: & \quad GDP = 3.10(360) + 4.25(310) + 2.40(80) = 3,585.50
\end{align*}
\]

b) Using your price index from (2a), calculate real GDP each year in terms of 2010 dollars.

\[
\begin{align*}
2010: & \quad RGDP = 2,245 \left( \frac{.91}{.91} \right) = 2,245 \\
2011: & \quad RGDP = 2,535.50 \left( \frac{.91}{1.00} \right) = 2,296.14 \\
2012: & \quad RGDP = 3,128.50 \left( \frac{.91}{1.10} \right) = 2,569.91 \\
2013: & \quad RGDP = 3,585.50 \left( \frac{.91}{1.21} \right) = 2,686.97
\end{align*}
\]

5) Now, we are going to construct a GDP deflator.

a) Using the production data from (3) and prices from 2010 in (2), calculate real GDP for each year.
2010: \( RGDP = 2.00(300) + 3.50(270) + 1.75(400) = 2,245 \)
2011: \( RGDP = 2.00(320) + 3.50(260) + 1.75(410) = 2,267.50 \)
2012: \( RGDP = 2.00(350) + 3.50(290) + 1.75(460) = 2,520 \)
2013: \( RGDP = 2.00(360) + 3.50(310) + 1.75(480) = 2,645 \)

b) Calculate the GDP deflator for each year.

Taking the nominal values from 3a and using the real values from above:

2010: \( P = \left( \frac{2245}{2245} \right) = 1.00 \)
2011: \( P = \left( \frac{2535.50}{2267.50} \right) = 1.12 \)
2012: \( P = \left( \frac{3128.50}{2520} \right) = 1.24 \)
2013: \( P = \left( \frac{3585.50}{2645} \right) = 1.36 \)

c) Calculate inflation each year using the GDP deflator.

\[ \pi = \left( \ln (1.12) - \ln (1.00) \right) \times 100 = 11.17\% \]
\[ \pi = \left( \ln (1.24) - \ln (1.12) \right) \times 100 = 10.45\% \]
\[ \pi = \left( \ln (1.36) - \ln (1.24) \right) \times 100 = 8.79\% \]

6) Suppose that you have the following series for real GDP.

<table>
<thead>
<tr>
<th>Year</th>
<th>Real GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>$3,250</td>
</tr>
<tr>
<td>2003</td>
<td>$3,450</td>
</tr>
<tr>
<td>2004</td>
<td>$3,500</td>
</tr>
<tr>
<td>2005</td>
<td>$3,700</td>
</tr>
</tbody>
</table>

- Calculate the trend rate of growth assuming a constant annual growth rate.
- Rewrite the series in terms of deviation from trend.

First, let’s calculate an average annual growth rate. We can do this two different ways:
\[
\left[ \frac{3,700}{3,250} \right]^1 - 1 \times 100 = 4.4\% \\
\]

Or,

\[
\frac{\ln(3,700) - \ln(3,250)}{3} \times 100 = 4.32\% \\
\]

Now, we need to extrapolate the future values...

3,250(1.044) = 3,393
3,250(1.044)^2 = 3,542
3,250(1.044)^3 = 3,698

Or,

3,250e^{0.0432} = 3,393
3,250e^{2(0.0432)} = 3,542
3,250e^{3(0.0432)} = 3,698

Now, calculate deviations from trend:

\[
\left( \frac{3,450 - 3,393}{3,393} \right) \times 100 = 1.68\% \\
\left( \frac{3,500 - 3,542}{3,542} \right) \times 100 = -1.12\% \\
\left( \frac{3,700 - 3,698}{3,698} \right) \times 100 = .05\% \\
\]