1) Since 1969, the Notre Dame endowment has grown from $60M to its 2005 value of $3.7B (this ranks Notre Dame as the 17th largest endowment in the country - Harvard is #1 with $22B).

- Calculate the total return on the endowment from 1969 to 2005. Calculate the annualized return.

This is tricky…we could calculate this using the usual percentage change formula

\[
\frac{3,700 - 60}{60} * 100 = 6,067\%
\]

Or, we could take the difference in natural logs

\[
\left[ \ln(3,700) - \ln(60) \right] * 100 = 412\%
\]

This is a big difference!

The cumulative 36 year return from 1969 to 2005 is 6,067%.

\[
\left[ \frac{3700}{60} \right]^{\frac{1}{36}} - 1 * 100 = 12.2\%
\]

Or,

\[
\frac{\ln(3,700) - \ln(60)}{36} * 100 = 11.4\%
\]

The average annual return is 12%

- What is the difference between a nominal variable and a real variable?

Nominal variables are in terms of current dollars. Real variables are in terms of a real good or service.
• The CPI in 1969 was 37 while the CPI in 2005 was 195 (1983 = 100). Convert both the 1969 endowment value and the 2005 endowment value to 1983 dollars.

First, scale up the 1969 endowment to 1983 dollars:

\[ E_{1969} = \left( \frac{60M}{37} \right) \times 100 = 162.16M \]

Now, scale back the 2005 endowment from 2005 dollars to 1983 dollars.

\[ E_{2005} = \left( \frac{3,700M}{195} \right) \times 100 = 1,897.43M \]

• Now, calculate the annualized real return the Notre Dame endowment.

Now, repeat part (b)

\[ \left[ \left( \frac{1,897}{162} \right)^{\frac{1}{36}} - 1 \right] \times 100 = 7.08\% \]

Or,

\[ \left[ \ln(1897) - \ln(162) \right] \times \frac{100}{36} = 6.83\% \]

The endowment earned an average real (inflation adjusted) return of 7%.

2) Suppose that the US and Germany produce two goods: Hot Dogs and Hamburgers. We have the following local prices and production levels in Germany and the US (US prices are in dollars, German prices are in Euro).

<table>
<thead>
<tr>
<th></th>
<th>US Production</th>
<th>German Production</th>
<th>US Price</th>
<th>German Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Dogs</td>
<td>3M</td>
<td>2.5M</td>
<td>$3.50</td>
<td>E 2.25</td>
</tr>
<tr>
<td>Hamburgers</td>
<td>6M</td>
<td>3M</td>
<td>$4.25</td>
<td>E 3.50</td>
</tr>
</tbody>
</table>

Suppose that the current exchange rate is $1.30 per Euro. Calculate GDP in the US and Germany using the PPP approach and the market exchange rate approach.

The PPP approach calculates GDP in both countries using prevailing prices in the US.

Germany: \( (2.5M)(3.50) + (3M)(4.25) = 19M \)

The market exchange rate approach calculates German GDP in Euro and then converts it to dollars with the current exchange rate.

Germany: \( (2.5M)(2.25) + (3M)(3.50) = E\ 21.5M \) (in Euros)  
Now, to convert to dollars, multiply by the exchange rate: \( E\ 21.5M \times 1.30 = \$27.95M \)

3) What is the Gini coefficient? If the Gini coefficient is increasing, what does this tell you about an economy? How might you explain the change in the Gini coefficient in the US over the past 50 years?

The Gini coefficient is a measure of income inequality. An increase in the Gini coefficient indicates that the distribution of income is becoming more uneven.

4) In 1980, the price level was 76.7 while today it is 208.6. Calculate the average annual inflation rate in the US over the past 27 years.

\[
\left( \frac{208.6}{76.7} \right)^{\frac{1}{27}} - 1 \times 100 = 3.77\%
\]

Or,

\[
\frac{\ln(208.6) - \ln(76.7)}{27} \times 100 = 3.70\%
\]

5) 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:
\[
\left( \frac{3,700}{3,250} \right)^{\frac{1}{3}} - 1 \right] \times 100 = 4.4\% \\
\]

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:

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