Assignment 05: Future Values

Learning Objectives
• Develop an intuitive understanding of the time value of money concepts of interest, compounding, future value, and present value.
• Develop a table to calculate the interest and compound interest on an investment.
• Learn how to use the built-in FV function to solve for future values.
• Learn how to use the built-in PV function to solve for present values.

Tasks
Using a spreadsheet program (e.g., Excel or Google Docs), build a spreadsheet that looks like the following, with an input cell at the top for the annual rate of interest. By changing this rate, every other value on your spreadsheet will recalculate. Create columns for year, initial value, interest earned, and ending value. To begin, you can mock up some values as per this example and work on the calculations:

<table>
<thead>
<tr>
<th>Year</th>
<th>Initial Value</th>
<th>Interest Earned</th>
<th>Ending Value</th>
<th>Simple Interest</th>
<th>Compound Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$2,000.00</td>
<td>$100.00</td>
<td>$2,100.00</td>
<td>$100.00</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>$2,100.00</td>
<td>$105.00</td>
<td>$2,205.00</td>
<td>$100.00</td>
<td>$5.00</td>
</tr>
<tr>
<td>3</td>
<td>$2,205.00</td>
<td>$110.25</td>
<td>$2,315.25</td>
<td>$100.00</td>
<td>$10.25</td>
</tr>
<tr>
<td>4</td>
<td>$2,315.25</td>
<td>$115.76</td>
<td>$2,431.01</td>
<td>$100.00</td>
<td>$15.76</td>
</tr>
<tr>
<td>5</td>
<td>$2,431.01</td>
<td>$121.55</td>
<td>$2,552.56</td>
<td>$100.00</td>
<td>$21.55</td>
</tr>
</tbody>
</table>

1. In each row, calculate the “interest” as:

   \[ \text{Interest earned} = \text{initial value} \times \text{interest rate} \]

2. In each row, calculate the “ending value” as:

   \[ \text{Ending value} = \text{initial value} + \text{interest} \]

3. After year 1, the initial value is the ending value from the previous year.

4. Simple interest is the interest earned on the initial investment. Compound interest is the interest earned on the interest. For each year, calculate the compound interest.

5. Make 2 bar graphs: (a) showing annual interest and ending wealth by year; and (b) showing the compound interest by year. In both cases, use the year as the x-axis.
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Questions
For questions 1, 2, and 3 that follow, copy your work to a new worksheet (tab) within your document. Label the tabs with the question numbers (i.e., q1, q2, q3).

1. Suppose you invest $5,000 for 30 years, at an annual interest rate of 5%.
   (a) Use your spreadsheet to find how much wealth will you have at the end of 30 years?
   (b) Solve the same problem using the Excel FV(rate, nper, 0, pv) function.

2. What interest rate do you need to earn on an initial investment of $20,000 to achieve a future value of $500,000 after 30 years? Hint: Use your spreadsheet to plug in different interest rates until you find out. Find out the closest basis point (a basis point is 1/100 of a percent).

3. How much do you need to invest today at 3% to be certain to accumulate a future value of $100,000 at the end of 10 years?
   (a) Use your spreadsheet. Try plugging in values to the “initial value for year 1” until you get the right amount at the end of year 10.
   (b) Solve the same problem using the Excel PV(rate, nper, 0, fv) function.

Solve questions 4, 5, 6 on the same worksheet using the FV or PV functions.

4. Suppose I offer you $100 to buy me a cup of coffee. I will pay you in 50 years. Is this a good deal?
   (a) What is the PV of $100 to be received in 50 years at 3% interest?
      hint: make a quick PV calculator, using the PV function
   (b) Suppose the rate of inflation is 5% per year for the next 50 years. What would a cup of coffee cost 50 years from now?
      hint: make a quick FV calculator, using the FV function. Use the inflation rate to “inflate” today’s cost for 50 years at 5% annual inflation.

5. How much would you need to invest at age 22 to accumulate $1,200,000 at age 65, assuming you earn a 3% investment return?

6. Suppose you are going to attend a 3-year law school program starting next year. The total cost including housing is estimated to be $65,000 one year from now; $67,000 two years from now; and $68,500 three years from now. Find the total present value of these costs, assuming a 2% interest rate.

What to Submit
Submit your Excel spreadsheet with each question on a separate worksheet (tab). Answer the questions in the worksheets.