



CPSC203 WEEK-3 LAB-1

ANALYSIS AND FORECASTING

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COURSE WEBSITE


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INTRODUCTION

You will work through an example of applying Excel's forecasting features to perform a compound interest calculation. The compound interest is the amount of money earned on a deposit during a period of time. It can be calculated using the following formula:

$$P = C (1 + r/n)^{nt} \quad \text{where}$$

- P = future value
 - C = initial deposit
 - r = interest rate (expressed as a fraction e.g. 0.06 = 6%)
 - n = # of times per year interest is compounded
 - t = number of years invested.
- 

FORECASTING

- You should setup your excel document so that it is easy to read and make modifications. Use the example layout as depicted below: This layout makes it easy to look up parts of the Compound Interest Formula as well as makes it easy to adjust the formula to try out new scenarios. Format your cells so that the correct number representation is shown, e.g. Initial Deposit is using the Currency Formatting while Interest Rate is using the Percentage Formatting.
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FORECASTING

analysis example copy - Microsoft Excel

Home Insert Page Layout Formulas Data Review View

Clipboard Font Alignment Number Styles Cells Editing

G17

Click to add header

Compound Interest Equation

Formula: $P = C(1 + r/n)^{(nt)}$

Legend

P = Future value
C = initial deposit
r = interest rate (expressed as a fraction: eg. 0.06)
n = # of times per year interest is compounded
t = number of years invested

Years Invested (t):	1
Initial Deposit (C):	\$ 10,000.00
Interest Rate (r):	6%

Demonstrations of Various Compounding

Compounded(n)	Final Principal (P)
1 (Yearly)	\$ 10,600.00
2 (Semi-Annually)	\$ 10,609.00

Sheet1

Ready Page: 1 of 1

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FORECASTING

Create a legend for your formula, and the 3 sections for Years Invested, Initial Deposit, and Interest Rate. After words create a table that will display the compounded times available and the final principal which will tell you how much money you earn given the compound frequency and the interest rate available. We will determine the Final Principal using the formula stated above.

Demonstrations of Various Compounding

Compounded(n)		Final Principal (P)	
1	(Yearly)	\$	10,600.00
2	(Semi-Annually)	\$	10,609.00
4	(Quarterly)	\$	10,613.64
12	(Monthly)	\$	10,616.78
52	(Weekly)	\$	10,618.00
365	(Daily)	\$	10,618.31



FORECASTING

For the Final Principal field, you will notice the formula used in the formula bar. $=\$B\$13*(1+(\$B\$14/A20))^{(A20*\$B\$12)}$

What do these values correspond to?

What do these values correspond to?

The screenshot shows an Excel spreadsheet titled "analysis example copy - Microsoft Excel". The formula bar for cell C20 contains the formula: $=\$B\$13*(1+(\$B\$14/A20))^{(A20*\$B\$12)}$.

Legend

- P = Future value
- C = initial deposit
- r = interest rate (expressed as a fraction: eg. 0.06)
- n = # of times per year interest is compounded
- t = number of years invested

Input values:

- Years Invested (t): 1
- Initial Deposit (C): \$ 10,000.00
- Interest Rate (r): 6%

Demonstrations of Various Compounding

Compounded (n)	Final Principal (P)
1 (Yearly)	\$ 10,600.00
2 (Semi-Annually)	\$ 10,609.00
4 (Quarterly)	\$ 10,613.64
12 (Monthly)	\$ 10,616.78
52 (Weekly)	\$ 10,618.00
365 (Daily)	\$ 10,618.31

Demonstration of Continuous Compounding

Compounded (n)	Final Principal (P)
Continuous	\$ 10,618.37

FORECASTING

Let us take a step by step look at how this formula was created and what these values correspond to. As you can see in the picture depicted below, the highlighted `B13` in the formula refers to cell B13 which is the value for Initial Deposit (C). The dollar signs (\$) are used because we want to keep this cell constant where ever we use the formula, we always want it to refer to B13 to get the value for Initial Deposit. This also makes it easy for you to change the initial deposit amount and experiment will different values without having to modify lots of different cells.



FORECASTING

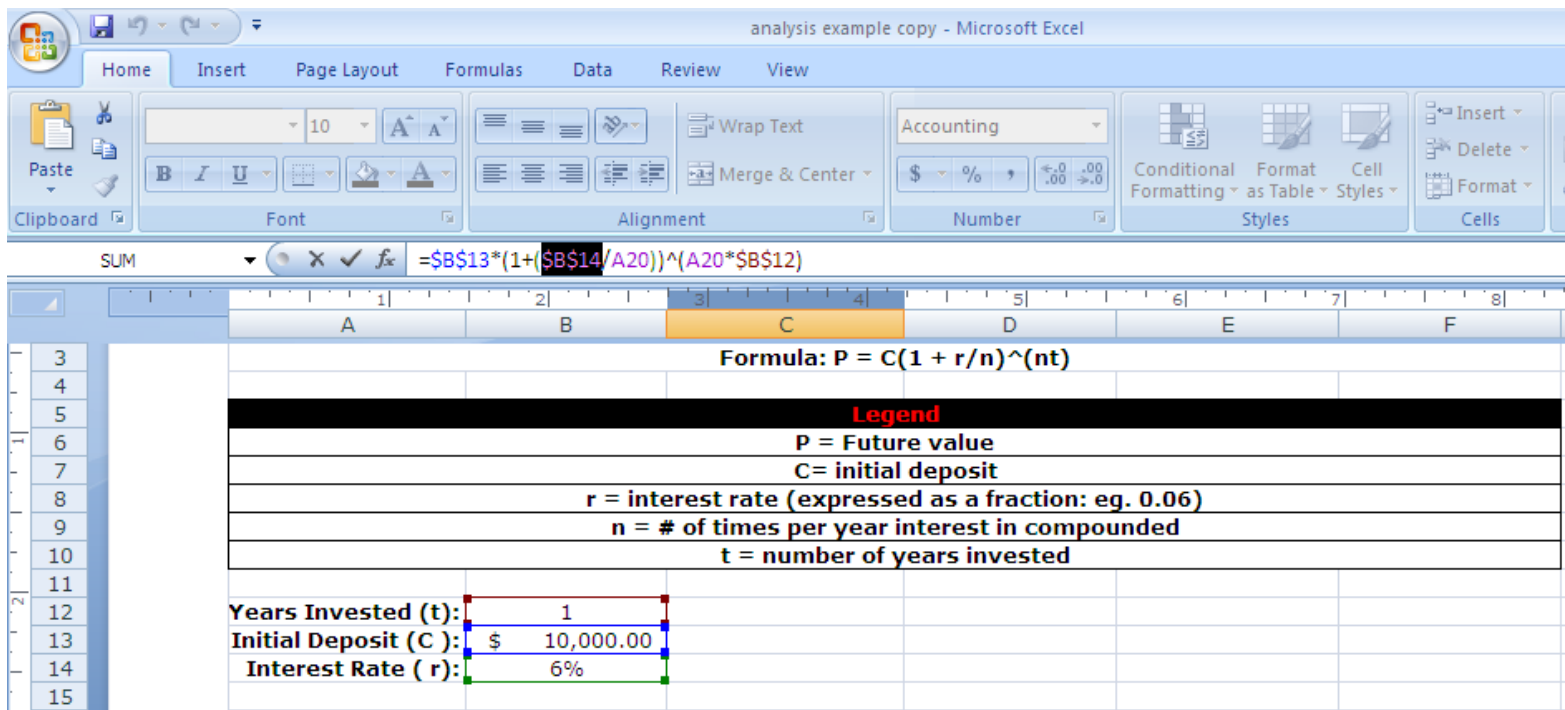
The screenshot shows the Microsoft Excel interface with the following elements:

- Title Bar:** analysis example copy - Microsoft Excel
- Formulas Bar:** $=\$B\$13*(1+(\$B\$14/A20))^{(A20*\$B\$12)}$
- Worksheet Grid:**
 - Row 3: **Formula: $P = C(1 + r/n)^{(nt)}$**
 - Row 5: **Legend**
 - Row 6: **P = Future value**
 - Row 7: **C = initial deposit**
 - Row 8: **r = interest rate (expressed as a fraction: eg. 0.06)**
 - Row 9: **n = # of times per year interest is compounded**
 - Row 10: **t = number of years invested**
 - Row 12: **Years Invested (t):** 1
 - Row 13: **Initial Deposit (C):** \$ 10,000.00
 - Row 14: **Interest Rate (r):** 6%



FORECASTING

Continuing on to the next variable in the formula, the highlighted $\$B\14 in the formula refers to cell B14 which is the value for the Interest Rate (r). Again the dollar signs (\$) are used because we want to keep this cell constant where ever we use the formula.



The screenshot shows the Microsoft Excel interface with the following details:

- File name: analysis example copy - Microsoft Excel
- Formula bar: $=\$B\$13*(1+(\$B\$14/A20))^{(A20*\$B\$12)}$
- Cell C3: Formula: $P = C(1 + r/n)^{(nt)}$
- Legend:
 - P = Future value**
 - C= initial deposit**
 - r = interest rate (expressed as a fraction: eg. 0.06)**
 - n = # of times per year interest is compounded**
 - t = number of years invested**
- Input values:
 - Years Invested (t): 1
 - Initial Deposit (C): \$ 10,000.00
 - Interest Rate (r): 6%



FORECASTING

Our last variable to examine in the formula for now is $\$B\12 which refers to cell B12 the number of years invested (t). Again the dollar signs (\$) are used because we want to keep this cell constant where ever we use the formula.

It should start look more obvious that the formula in the formula bar is matching the one given earlier of $P = C(1 + r/n)^{(nt)}$.



FORECASTING

analysis example copy - Microsoft Excel

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Clipboard Font Alignment Number Styles Cells

SUM $=\$B\$13*(1+(\$B\$14/A20))^{A20*\$B\$12}$

	A	B	C	D	E	F
3			Formula: $P = C(1 + r/n)^{(nt)}$			
4						
5			Legend			
6			P = Future value			
7			C = initial deposit			
8			r = interest rate (expressed as a fraction: eg. 0.06)			
9			n = # of times per year interest is compounded			
10			t = number of years invested			
11						
12		Years Invested (t):	1			
13		Initial Deposit (C):	\$ 10,000.00			
14		Interest Rate (r):	6%			



FORECASTING

So that leaves us with A20 in the formula, A20 refers to the number of times per year that interest is compounded. Here we have created a table with lots of different options for compounding events which include: Yearly, Monthly, Quarterly, Daily, etc. NOTE: we refer to A20 which contains a number and not B21 as it just contains text. Our formula requires numbers to be used.



FORECASTING

analysis example copy - Microsoft Excel

Home Insert Page Layout Formulas Data Review View

Clipboard Font Alignment Number Styles Cells

SUM $=\$B\$13*(1+(\$B\$14/A20))^{(A20*\$B\$12)}$

	A	B	C	D	E	F
3	Formula: $P = C(1 + r/n)^{(nt)}$					
4	Legend					
5	P = Future value					
6	C = initial deposit					
7	r = interest rate (expressed as a fraction: eg. 0.06)					
8	n = # of times per year interest is compounded					
9	t = number of years invested					
10						
11						
12	Years Invested (t):		1			
13	Initial Deposit (C):	\$	10,000.00			
14	Interest Rate (r):		6%			
15						
16						
17	Demonstrations of Various Compounding					
18						
19						
20						

Compounded(n) Final Principal (P)

1 (Yearly) $+(\$B\$14/A20)^{(A20*\$B\$12)}$

FORECASTING

Looking at the next compounding event, Semi-Annually, you will see that in the formula A20 becomes A21. Meanwhile all the other variables in the formula have not changed because of course we are using the dollar signs (\$) to keep those values constant. If you examine the remaining compounding events you will see the same thing occurring, A21 becomes A22, A22 becomes A23 to reflect the changing compounding event.

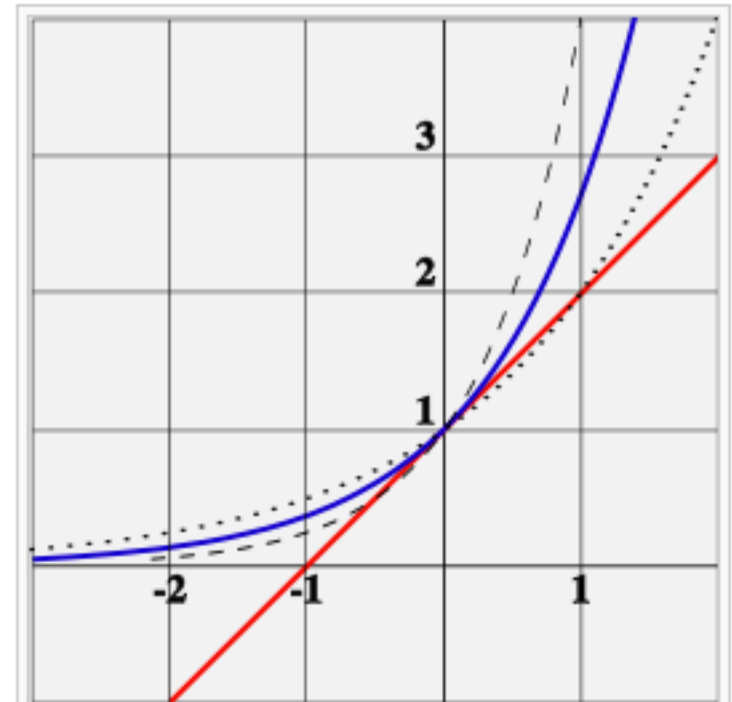


FORECASTING

So what about *Continuous Compounding Interest*? This type of calculation requires a slightly different but similar formula but is very simple for you to calculate. First we need to introduce the new formula and a new variable.

$$P = C e^{(rt)}$$

So the e variable, is a mathematical constant that is used for this formula, you can refer to it in calculation using **EXP(1)**.



e is the unique number a , such that the value of the derivative (the slope of the tangent line) of the exponential function $f(x) = a^x$ (blue curve) at the point $x = 0$ is exactly 1. For comparison, functions 2^x (dotted curve) and 4^x (dashed curve) are shown; they are not tangent to the line of slope 1 (red).

FORECASTING

So here is the e mathematical constant variable used in the formula.

The screenshot shows the Microsoft Excel interface with the following content:

Formula Bar: $=B\$13*EXP(1)^(B\$14*B\$12)$

	A	B	C	D	E	F
13	Initial Deposit (C):	\$	10,000.00			
14	Interest Rate (r):		6%			
15						
16						
17	Demonstrations of Various Compounding					
18						
19		Compounded(n)	Final Principal (P)			
20		1 (Yearly)	\$ 10,600.00			
21		2 (Semi-Annually)	\$ 10,609.00			
22		4 (Quarterly)	\$ 10,613.64			
23		12 (Monthly)	\$ 10,616.78			
24		52 (Weekly)	\$ 10,618.00			
25		365 (Daily)	\$ 10,618.31			
26						
27	Demonstration of Continuous Compounding					
28						
29						
30						
31						
32		Compounded(n)	Final Principal (P)			
33		Continuous	$=B\$13*EXP(1)^(B\$14*B\$12)$			

Legend
 $e = \text{Mathematical Constant } (e = 2.71828\ 18284\ 59045\ 23536\dots)$

FORECASTING

Make a chart with this compound interest values:

Analysis_example [Compatibility Mode] - Microsoft Excel

Home Insert Page Layout Formulas Data Review View

Clipboard Font Alignment Number Styles Cells Editing

B20 (Yearly)

Compound Interest Equation

Formula: $P = C(1 + r/n)^{nt}$

Legend

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Years Invested (t): 1
Initial Deposit (C): \$ 10,000.00
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Continuous	\$ 10,618.37

Demonstration of Continuous Compounding

Formula: $P = C e^{rt}$

Legend

e = Mathematical Constant (e = 2.71828 18284 59045 23536...)

Compounded (n)	Final Principal (P)
Continuous	\$ 10,618.37

Sheet1

Ready Average: 10613.44148 Count: 14 Sum: 74294.09039 100%

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FORECASTING

Make a chart with this compound interest values:

Microsoft Excel - Analysis_example [Compatibility Mode]

Chart Tools: Design, Layout, Format

Chart 8

Compound Interest Equation

Formula: $P = C(1 + r/n)^{nt}$

Legend
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 C = initial deposit
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Demonstration of Continuous Compounding

Formula: $P = C e^{rt}$

Legend
 e = Mathematical Constant (e = 2.71828 18284 59045 23536...)

Compounded (n)	Final Principal (P)
Continuous	\$ 10,618.37

Chart Data:

Compounding Frequency	Final Principal (P)
(Yearly)	\$ 10,600.00
(Semi-Annually)	\$ 10,609.00
(Quarterly)	\$ 10,613.64
(Monthly)	\$ 10,616.78
(Weekly)	\$ 10,618.00
(Daily)	\$ 10,618.31
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