Math 1090   Project 1

(Work in groups of two to four.)

Names _____

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Future Value

Setup: This schedule shows a record of payments, interest earned, and a running balance. Set up a spreadsheet similar to the example below with fixed values at the beginning such as: the annual interest rate (APR, formatted as "percentage" with 3 decimal places in cell C2), the amount of each payment (formatted as "currency" in cell C3), and the number of payments per year (in cell C4).

	A	B	C
1	ANNUITY		
2		Interest Rate	
3		Payment Amount	
4		Number Payments per Year	
5	Payment #	$ Interest	$ New Amount
6			
7			
8			

It is good to start counting with zero, so enter a zero in cell A6. In cell A7 enter the formula =1+A6 which will count the payments. In cell B7, enter the formula =$C$2 /$C$4*C6 with the dollar signs before the row names and column names so that all the formulas copied down from here will continue to refer to the interest rate in C2 divided by the number of payments per year in C4, times the amount in the account at the end of the previous month, in cell C5 now. In cell C7, enter the formula =$C$3+B7+C6 in order to add the monthly payment in C3 without changing as the formula is copied to the rest of the months, to the interest earned that month in B7 and the amount from the previous months in cell C6. Format cells B7 and C7 as number "currency," so your spreadsheet looks like the following:

	A	B	C
1	ANNUITY		
2		Interest Rate	
3		Payment Amount	
4		Number Payments per Year	
5	Payment #	$ Interest	$ New Amount
6	0		
7	1	$0.00	$0.00
8			

Save this spreadsheet so can work as a template. It is now ready to begin entering values to see how it works.

Example: Try out your template by creating a schedule for someone make $25.50 monthly payments into an account that pays 6.5% APR. Enter 0.065 in cell C2, 25.5 in cell C3, and 12 in cell C4. Now copy the formulas in cells A7 to C7 by holding down the Shift key while dragging the mouse through those cells so they are selected, and choose Copy from the Edit menu. Now hold the Shift key down while selecting cells A8 to C24 (or anywhere farther down in column C). Finally choose Paste from the Edit menu. After adjusting the column widths, the first few rows of his spreadsheet now look like the following:

	A	B	C
1	ANNUITY		
2		Interest Rate	6.50%
3		Payment Amount	$25.50
4		Number Payments per Year	12
5	Payment #	$ Interest	$ New Amount
6	0		
7	1	$0.00	$25.50
8	2	$0.14	$51.14
9	3	$0.28	$76.92
10	4	$0.42	$102.83

Assignment:

1a. Set up a spreadsheet to show the semiannual interest earned and account balance for $400 invested in an account at the beginning of each 6-month for three years, for an account that promises to pay 10% APR, compounded semiannually. (There should be six payments.) Print the spreadsheet and use a highlighter to show the account balance at the end of each year. [1]

b. Change the spreadsheet in problem1a above to show the quarterly interest earned and quarterly account balance for an ordinary annuity of $200 a quarter for three years at 10% APR. (How many payments will there be?) Print the spreadsheet and highlight the account balance at the end of each year.

c. Write a short paragraph explaining what you observed when the amount paid into the annuity and the interest rate remained constant, but the payment periods change.

2a. Set up a spreadsheet to show the monthly interest earned and monthly account balance for an ordinary annuity of $300 a month at 9% APR for 12 years. (How many payments will there be?) Print the spreadsheet and highlight the account balance at the end of each year. [2]

b. Change the spreadsheet in problem 2a above to show the monthly interest earned and monthly account balance for an annuity due of $300 a month at 9% APR for 12 years. In order to get paid interest on the payment from the first of the month plus the account balance from the previous month, you will need to change the formula in cell B7 to =($C$3+C6)*$C$2/$C$4. Enter and copy this formula, then paste it to cells B8 on down as far as you need it. Print the spreadsheet and highlight the account balance at the end of each year.

c. Write a short paragraph explaining what you observed when the annual amount paid into the annuity and the interest rate remained constant while changing the time the interest is paid from the first to the end of the pay period.

3a. Set up a spreadsheet to show the quarterly interest earned and quarterly account balance for an ordinary annuity of $100 each quarter at 8% APR for 25 years. **Do not print the whole schedule. Only write the amounts of interest paid, and new amount, for end of the 5th year, the end of the 10th year, the end of the 20th year, the last payment, in the table below**. [3] (Notice: the Payment # and the year number are not the same number.)

		Interest Rate	8%
		Payment Amount	$100.00
		Number Payments per Year	4
Payment #		$ Interest	$ New Amount
0			
20			
40			
80			
100			

b.

Change the spreadsheet in problem 3a above to show the quarterly interest earned and quarterly account balance for an ordinary annuity of $110 each quarter at 8% APR for 25 years. **Do not print the whole schedule. Only write the amounts of interest paid, and new amount, for end of the 5th year, the end of the 10th year, the end of the 20th year, the last payment, in the table below**.

		Interest Rate	8%
		Payment Amount	$110.00
		Number Payments per Year	4
Payment #		$ Interest	$ New Amount
0			
20			
40			
80			
100			

c. What is the total contributed to each annuity after 10 years, 20 years, and 25 years?

d. What is the difference between these amounts and the amounts in the accounts after 10 years, 20 years, and 25 years?

e. Why are these amounts more than the differences in the amounts contributed?

4. Suppose a wise couple deposited $1000 at the end of each quarter in an account that earned 7.6% APR, compounded quarterly, for the first eight years. Then they start a family and find that they can only contribute $200 per quarter for the remaining 18½ years when the child is old enough for college. Setup a spreadsheet to look at the schedule of payments. Be sure to include a place at the beginning for each payment, and be sure to change the reference cell from C3 (1000) to C4 (200) after the eighth year (32nd payment). **Do not print the whole schedule. Only write the payment numbers, amounts of interest paid, and new amount, in the table below**. [4]

	Interest Rate	7.6%
	Payment first 8 years	$1000.00
	Payment last 18½ years	$200.00
	Number Payments per Year	4
Payment #	$ Interest	$ New Amount
0		
20		
32		
33		
40		
60		
73		
74		

[1] Based on problem #28, page 462, Harshbarger & Reynolds, Mathematical Applications, 7th ed.
[2] Based on problem #27, page 462, Harshbarger & Reynolds, Mathematical Applications, 7th ed.
[3] Based on problem #38, page 462, Harshbarger & Reynolds, Mathematical Applications, 7th ed.
[4] Based on problem #36, page 462, Harshbarger & Reynolds, Mathematical Applications, 7th ed.