Early to bed and early to rise makes a man healthy, wealthy, and wise.

Ben Franklin

NOTE: Compute all dollar-denominated answers to the nearest dollar unless otherwise specified, and compute all other answers to four decimal places (*i.e.,* .0001). Excel hints are given in brackets.

You will need to download the HW4 spreadsheet. Please rename it and use it to answer all of the HW4 problems. Please submit HW4 as an Excel spreadsheet.

1. Able and Baker both just turned 19 years old today. Baker, who is a bit more serious than Able, saves $2,000 per year from age 19 through 26 and then, after becoming a social justice warrior, stops contributing but leaves the money invested. Able protests and parties until he turns 26 and joins Goldman Sachs and then begins saving $2,000 per year until age 65. All contributions are made at year end. When they are about to turn 66, who has more money and how much more? *[FV for Baker and FV twice for Able]*

2. H&R Block prepares your tax return, which shows a refund of $4,000. Your friendly, personal service agent tells you that you will receive your refund check in exactly two weeks, but he so kindly offers to advance you the entire amount today less a very small *service fee* of $40. You agree to assign your refund check to him and happily walk out of his office with $3,960. As you should see, you have borrowed $3,960 today from H&R and repaid $4,000 two weeks later.

   (a) What's the APR of this loan?

   (b) What's the EAR of this loan?

   (c) Should you ever do this? Do you now view differently ATM fees?

3. You borrow $500,000 at 3.00% per year (APR, not EAR) for 30 years to purchase a two bedroom apartment in some city that is not New York.

   (a) What is your monthly payment? *[PMT]*

   (b) What is the total amount of interest that you will pay on this loan?

   (c) What is the loan principal after 15 years of payments?

   (d) If you make an additional monthly payment of $250, in how many years will the loan be repaid? *[NPER or N]*

   (e) Using the original facts, if you want to repay the loan in 15 years instead of 30, how much more do you need to pay each month? *[PMT] and [NPER or N]*

(f) Using the original facts, immediately after the 72nd payment, you receive a $50,000 bonus, which you use to pay down the principal. By how many years and months do you reduce the mortgage? *Note: When you prepay a mortgage, your monthly payment does not change but the interest that accrues each month is less (because the principal is less), and you will make fewer payments. [PV and NPER*]

4. Same **original** facts as the previous problem, except now assume that the bank charges you an upfront fee of 2.0 "points." A point, in loan parlance, means 1% of the loan amount. Thus, if you borrow $100,000 and pay 2.0 points, you must pay $2,000. Even though you receive only the loan proceeds *less* the points paid, you must repay the *entire* amount using the amortization schedule for that amount. Points paid are economically equivalent to additional interest on the loan, except the interest is paid upfront. (You should convince yourself that the result is the same whether the bank deducts the points from the loan proceeds or you write a separate check for them.)

   (a) What is your true annual interest rate (use APR) as a result of paying the 2.0 points assuming you pay off the loan over the original 30 year term? *[Rate].* **Hint:** *The PMT is calculated using the loan amount, but the amount you receive (borrow) is the loan amount less the points.*

   (b) Now assume that you pay off the remaining loan balance at the end of three years instead of over 30 years. What is the true interest rate (use APR) that you have paid over the three years?

   Here's a way to think about the problem. Assume you repay the loan after one day. You will have borrowed the net proceeds (after points) but must repay the entire $500,000 balance and one day's interest. You can see that's indeed a hefty interest rate. If, however, the loan is repaid over 30 years as in (a) above, the extra interest is spread over the 30 years. Your true interest rate over 3 years is going to fall between the rate in (a) and the rate you pay when you borrow the net proceeds and repay $500,000 one day later.

   There are a couple of ways to tackle this problem.

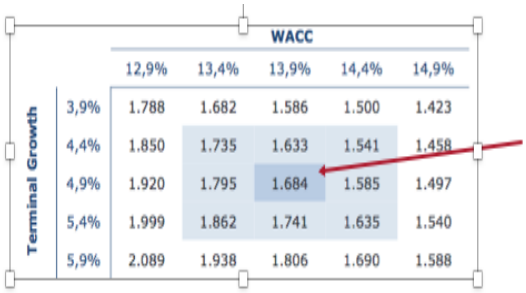
      i. The easiest is to use *IRR*. Input the cash flows—the points, the loan proceeds, the 36 payments, and the loan repayment (the loan balance at the end of the 3 years)—using the correct sign convention, positive for inflows and negative for outflows. *IRR* will give you the correct answer.

      ii. To solve it using the *NPER, RATE, PV, PMT, and FV* formulas, remember that your PV is the net loan proceeds (after points), your PMT remains the same, but the FV is the amount that you owe to the bank after 36

payments–you must calculate that.

5. In some situations, the various financial inputs, e.g., cash flows, interest rates, revenues, etc., can vary. In the previous example, the final price of the apartment, total loan amount, and mortgage interest rate could change depending on market conditions and negotiations. A *two-way data table* is a useful way to calculate and display the results of changes in two inputs in the form of a table, which obviates the need to make separate calculations for each combination. For instance, you might like to know your monthly payment for various combinations of interest rates and mortgage amounts.

   Below is an excerpt from an acquisition I worked on three years ago that shows various values (in billions) for different combinations of WACC and Terminal Growth Rates.



		WACC				
		12,9%	13,4%	13,9%	14,4%	14,9%
Terminal Growth	3,9%	1.788	1.682	1.586	1.500	1.423
	4,4%	1.850	1.735	1.633	1.541	1.458
	4,9%	1.920	1.795	1.684	1.585	1.497
	5,4%	1.999	1.862	1.741	1.635	1.540
	5,9%	2.089	1.938	1.806	1.690	1.588

Figure 1: Acquisition Price for Various Combinations of WACC and Terminal Growth Rates

Download the Excel spreadsheet next to Homework 4 and create a two-way data table that contains the monthly payments for various combinations of interest rates and loan amounts. Useful examples can be found on YouTube, Google, or Excel Help. You'll see that I've entered the loan amount, annual interest rate, and term of the mortgage. First determine the Payment in C5. In C11:C14, you will input various loan amounts beginning with $500,000 in C11 and increasing by $20,000 for each successive row. In cells D10:G10, you will do the same for the interest rate, which should begin wtih 3.00% and increase by 25 bps.

Note, the interest rate and mortgage amounts entered in C11:C14 and D10:G10 cannot refer to the cells that contain those inputs and that are used to calculate the Payment in C5, i.e., C2 and C3. It's an Excel thing. You can type in the values, but maybe a better way is to refer to other cells that contain the beginning Annual Interest Rate and Loan Amount and then increase those amounts by $20,000 (or some other amount) that is in another cell. This helps make the table a bit more

dynamic. If you've done it correctly, each entry in table will look something like, =TABLE(C3,C2)