Industry, Perseverance, & Frugality,
make Fortune yield.

Ben Franklin

NOTE: Compute all dollar-denominated answers to the nearest dollar, and compute all other answers to four decimal places (*i.e.,* 7.62%). For the multiple choice questions, give the correct choice and very briefly explain your answer.

Let's start off with a couple of personal finance questions.

1. Starting at end of 2020, big law lawyer Luiza saves $10,000 per year for 10 years. She then discovers that corporate law practice isn't making her happy and opts to work for one of those charities that raises money to battle some fashionably fatal disease. For the rest of her working life, she doesn't earn enough money to add to her retirement account, but leaves the entire 2029 ending balance invested for the next 30 years.

   Lazy Larry comes late in life to a knowledge of the time value of money and at the end of 2030 begins to save $10,000 per year for the next 30 years. Both Luiza and Lazy earn 7% per year.

   Who finishes the race with the most money at the end of 2059? In sum, Luiza invests $10,000 for 10 years and allows that balance to grow for 30 years, and Lazy invests $10,000 for 30 years. *[FV]*

2. You borrow $500,000 at 7% per year (APR, not EAR) for 30 years to purchase an apartment (in some city that is not New York).

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

   (b) At the beginning of 2022, the rate on a 30-year mortgage was 3%. What would have been your monthly payment? *[PMT]*

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

   (d) 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]*

   (e) 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*]

3. Go to web page and download the data spreadsheet for this HW. You'll see the annual percentage returns for the Wilshire 5000 index and the MSCI BIC index since 1998. Note, the BIC index used to be the BRIC index, with the "R" representing Russia. For some reason, Russia was recently removed from the index. The Wilshire 5000 is an index that represents the entire U.S. stock market, and the BIC countries are Brazil, India, and China. Since the BIC index is market weighted, Chinese companies represent about 60% of the index.
   (a) What is the average (arithmetic) yearly return of each index since 1998?
   (b) What is the average (geometric) yearly return of each index since 1998?
   (c) What are the respective variances (use the **VAR.S** function) and standard deviations (use **STDEV.S**) of the returns of the Wilshire 5000 index and the MSCI BIC index?
   (d) What is the correlation (**CORREL**) of the two returns since 1998?
   (e) What is the covariance (**COVAR**) of the two returns since 1998?
   (f) What is the $\beta_{BIC,W5000}$ (**SLOPE**) of the two returns since 1998.
4. Write down the CAPM formula. Which of the inputs are project specific and which are systematic?
5. What does a stock's market-beta indicate? What does it mean if a stock has a negative market-beta?
6. Beta and standard deviation differ as risk measures in that beta measures:
   (a) Only unsystematic risk, while standard deviation measures total risk
   (b) Only systematic risk, while standard deviation measure total risk
   (c) Both systematic and unsystematic risk, while standard deviation measures only unsystematic risk
   (d) Both systematic and unsystematic risk, while standard deviation measures only systematic risk
7. The measure of risk for a security held in a diversified portfolio is:
   (a) Specific or unique risk
   (b) Standard deviation of returns
   (c) Reinvestment risk
   (d) Covariance

(e) Risky Business

8. Which of the following statements is (are) necessarily true?

   (a) If a stock's returns are positively correlated with the returns of the general market, it will have a market-beta equal to +1.0.

   (b) If a stock's returns are negatively correlated with the returns of the general market, it will have a market-beta equal to -1.0.

   (c) If a stock's returns are negatively correlated with the returns of the general market, it will have a negative market-beta.

   (d) Both A and B are true.

9. You have divided your money equally between two stocks. Both have expected returns of 12%, standard deviations of 18%, and βs of 1.1. Assume the returns of the two stocks are *not* perfectly positively correlated. Which of the following statements is (are) necessarily true?

   (a) The expected return on your portfolio is 12%.

   (b) The standard deviation of the portfolio returns is 18%.

   (c) The β of your portfolio is less than 1.1.

   (d) Both A and B are true statements.

10. If you put 10K into T-bills and 20K into the SP500 (assume it's the market portfolio), what will be the beta of your portfolio?

11. Use the CAPM to estimate the risk-adjusted market rate of return on an investment with $\beta = 1.1$ if the risk-free rate is 3% and the market premium 5%.

12. XYZ Corporation has β=0.75 and \$100 million in equity capital (100 million shares with a market value of \$1 each) and no debt. Suppose that XYZ refinances (replaces) some of its equity with debt—it borrows \$40 million and buys back \$40 million of its equity—so that it now has \$60 million in equity capital and \$40 million in debt. Assume the debt is risk free and the rate is 5% and the equity premium is 4%. XYZ otherwise continues in the same business, with the same amount of total capital.

    (a) Describe qualitatively the effect of the refinancing on the β of XYZ's stock (equity).

    (b) Describe qualitatively the effect of the refinancing on the β of XYZ's assets.

    (c) If you ignore the risk of default on XYZ's debt and ignore taxes, what should the β of XYZ's stock be after the refinancing?

(d) According to the CAPM, what is the E(r) XYZ has to offer its shareholders?

(e) What's XYZ's WACC before and after the refinancing? Assume we live in a no-tax world.