Notes: 1) “Annuity” and “perpetuity” may have growing or constant cash flows. 2) While you are welcome to solve any problem to a final answer, you will only earn points for setting them up. “Setting up” means writing down the appropriate equations and plugging in the appropriate numbers. For multistep problems, you can plug unsolved variables into later steps. Note however, that some problems will require some calculations for you to figure out how to solve them.

**Short Answer (15 points each)**

1. Assume a risk-free bond pays $1000 a year from today. If you can borrow or lend at a risk-free rate of 3%, what is the no-arbitrage price of the bond?

2. How would you close out a short position of 100 shares Google stock?

3. Assume you want to borrow $20,000 to buy a car. Because of a deferred payment clause, you would not have to make any payments until three months from today (but interest would start accruing immediately). List the sequence of steps that would allow you to solve for your monthly payment. If you are not solving for the name of the step (like future value of an annuity), state which variable you are solving for in each step (like r or N).

In answering questions 4 and 5, assume you have just purchased a growth bond that pays its first coupon four months from today. After this initial coupon of $100, the bond will continue to make semiannual payments through 10 years and four months from today. However, unlike a traditional bond, each coupon payment will be 2% larger than the previous payment. If you buy the bond, you would need to earn a rate of 8% per year on the bond. To solve for the value of the coupons, you plan to 1) calculate the present value of an annuity and then 2) calculate the future value of a single cash flow.

4. What would you use for “r” in step 1?

5. If you use the rate you found in 4 above, what would you use for “N” or “n” in step 2?

6. List (but do not discuss) three conditions under which the following decision rule cannot or should not be used for making capital budgeting decisions: Accept the project with the highest internal rate of return.

7. Assume you purchased 100 shares of General Mills at the end of the day on April 7th and sold your shares at the end of the day on July 21st. Based on the following dividend and price data on General Mills, what rate of return did you earn over this period if you reinvested any dividends you received?

 Date Dividend Price Days

 4/7/11 0.28 35.99 0

 7/7/11 .305 37.01 91

 7/21/11 - 37.85 105

8. You estimate that over the next year there is a 30% chance that Xelon stock will rise 40%, a 25% chance that Xelon stock will rise 5%, and a 45% chance that Xelon stock will fall 20%. What is the expected return on Xelon stock?

In answering questions 9 and 10, assume you can invest in Appley Co. with an expected return of 21% and a standard deviation of returns of 45% and in Zillion Co with an expected return of 14% and a standard deviation of returns of 29%. Assume also that risk-free bonds earn 3%. Note: answer both questions on the same graph.

9. Sketch a graph of all possible the risk/return combinations you can achieve if you limit your trades to the two stocks. Show the portfolio you will achieve if you short sell $10,000 of Zillion and invest $110,000 in Appley.

10. If you are also willing to trade risk-free bonds, what portfolio with the same expected return as your portfolio in 9 gives you the least risk? Show how the risk of this portfolio compares to the risk of your portfolio in 9.

**Problems (75 points each)**

1. Assume that a share of the market portfolio pays either $140 or $75 a year from today and that a share of Zillos Inc. pays either $100 or $35 a year from today. The current market price of the market portfolio is $95 and the current market price of Zillos is $60. Assume also that the risk-free interest rate is 4%. Note: you will need to do some actual calculations to solve this problem.

a. What set of transactions today would create an arbitrage profit?

b. Show that the conditions for arbitrage are met today and a year from today.

2. Assume that you have just deposited $100 into a bank account that earns an APR of 3% per year with monthly compounding. You plan to make additional monthly deposits of $100 each through one year and six months from today. Two years and one month from today, you plan to make the first of a series of quarterly withdrawals from the account. You would like for these withdrawals to grow by 1% each and to continue through three years and ten months from today. What is your first withdrawal?

3. Use the following return data to answer parts a through d.

Year Krunchy Cereal S&P500

4 -4% +20%

3 +29% +30%

2 -6% -40%

1 -1% -4%

Average R ?

Variance V ?

a. What was the average return on the S&P500?

b. What was the variance of returns on the S&P500?

c. Let R stand for the average return on Krunchy Cereal and V stand for the variance of returns on Krunchy Cereal. What is the covariance between the returns on Krunchy and the S&P500?

d. Let R stand for the average return on Krunchy Cereal and V stand for the variance of returns on Krunchy Cereal. What is Krunchy Cereal’s beta?

4. News Hackers Inc. is considering whether or not to build a new factory. The factory would cost $1,000,000 and would fall into the 10-year MACRS class. The factory is expected to generate sales of $3,500,000 a year from today and subsequent sales are expected to grow at a rate of 3% per year. Cost of Goods sold are expected to equal 60% of sales. Fixed costs (excluding depreciation) associated with the new plant are expected to equal $1,500,000 per year. New Hacker’s tax rate equals 35%.

If the firm undertakes the project, then the increase in the firm’s current assets and current liabilities (compared to if the project is not undertaken) at the end of years 0 (today) through 5 equals:

 Year 0 Year 1 Year 2 Year 3 Year 4 Year 5

Cash 75,000 135,000 175,000 185,000 155,000 150,000

Accounts Receivable 0 315,000 335,000 380,000 385,000 400,000

Inventory 295,000 300,000 360,000 375,000 380,000 385,000

Accounts Payable 240,000 275,000 310,000 300,000 305,000 350,000

How will building the new factory affect New Hacker’s unlevered net income and free cash flow **four years from today**?