

**Math 5621 Financial Math II**  
**Fall 2011**

**Final Exam**

December 9 to December 14, 2011

This is an open book take-home exam. You may consult any books, notes, websites or other printed material that you wish. Having so consulted then submit your own answers as written by you.

Do NOT under any circumstances consult with any other person. Do NOT under any circumstances cut and paste any material from another source electronically into your answer. Do NOT under any circumstances electronically copy a spreadsheet that was not created by you. Failure to follow these rules will be grounds for a failing grade for the course.

Put your name on all papers submitted and please show all of your work so that I can see your reasoning. The eight questions will be equally weighted in the grading. Please return the completed exams by 5:30 PM Wednesday, December 14 to my mailbox in the department office, under my office door MSB408, or by email.

1. Build a binomial pricing model using the following assumptions:  $r_f = .02$ ,  $\sigma = .22$ ,  $T = 2$ ,  $N = 4$ ,  $S_0 = 50$ , and  $q_u = 1/2$ . (Do NOT use any other choice for  $q_u$ ). Use the model to price an American Put option on  $S$  with strike price 65 expiring at  $T = 2$ . What is the value of the put? What is the value of the position held in  $S_0$  at time 0 in the replicating portfolio?
2. Using the same assumptions as question #1, according to the Black-Scholes formula what is the value of the position held in  $S_0$  at time 0 in the hedging portfolio for a European Put expiring at  $T = 2$ ?
3. An investor's entire portfolio consists of 25% in the risk free investment, with a return of .03, and the balance invested in two stocks  $S_1$  and  $S_2$  where  $r_1 = .08$ ,  $r_2 = .12$ ,  $\sigma_1^2 = .04$ ,  $\sigma_2^2 = .09$ , and  $\rho_{12} = .6$ . What is the expected return  $r_P$  and the variance of return  $\sigma_P^2$  on the investor's entire portfolio? Don't just fill values into a formula for how much of each of the two stocks is in the portfolio unless you also prove that formula.
4. The cash flows from three projects  $A$ ,  $B$ , and  $C$  are shown in the table.  $A$  and  $B$  are mutually exclusive. You can do neither or you can do one, you can't do both.  $C$  is independent of  $A$  and  $B$ . The discount rate is 10% for all three projects. Which project or combination of projects is preferable according to (a) the net present value method (b) the internal rate of return method (c) the modified internal rate of return method?

Year	$A$	$B$	$C$
0	-1	-1	-1
1	0	1	0
2	2	0	0
3	-1	1	3

Show the calculations for each method.

5. A company has net assets with a market value of \$5,000,000 and a financial structure involving 50% debt. The company believes that its financial structure is optimal. The company is considering a new project that requires an investment of \$1,250,000. Taking on the project will leave the company's overall relative operating risk exactly where it is before taking on the project. If the company's after tax *WACC* is 15%, its marginal cost of new debt is 6% before tax, and its marginal tax rate is 40%, then what after tax rate of return does the project need to earn in order to be acceptable, assuming that it will be financed optimally?
6. How would each of the following actions affect a firm's quick ratio?
  - (a) Sell inventory for cash
  - (b) Borrow short term from a bank to pay a supplier
  - (c) collect an overdue bill from a customer
  - (d) Buy more inventory for cash
7. Your firm's planning model has four scenarios for the future, *A*, *B*, *C*, and *D*. In scenario *A*, which your model assigns probability .4, the market returns .15 and your firm returns .20. In scenario *B*, which your model assigns probability .35, the market returns .05 and your firm returns zero. In scenario *C*, which your model assigns probability .2, the market return is .20 while your firm returns .50. In scenario *D*, which your model assigns the remaining probability, the market returns  $-.15$  while the return on your firm is  $-.30$ . The risk free rate is 2%. Calculate the expected return and variance of return for your firm and for the market. Calculate the covariance of the return for your firm with the market return. What expected return will the market demand for the firm? If you believe the model is true in all respects, what prediction would you make for the price of the firm's shares relative to the market?
8. Alpha Gaming has a current price of \$20 per share. Its annual sales are \$12,000,000,000. Total annual expenses including depreciation, amortization, interest, and taxes are \$10,500,000,000. On a book value basis debt is \$3,600,000,000. The payout ratio is 75%. The price/book ratio is 300%. There are 400 million shares outstanding. What is the maximum possible growth rate Alpha Gaming can sustain without increasing its debt ratio or issuing new equity capital?