

IEMS 326, Homework 2, Due 4/20/2011

1. For these problems you don't have to use an annual cash flow analysis if you don't want to.
 - a) Newnan et al. chapter 6 problem 33.
 - b) Newnan et al. chapter 6 problem 42.
 - c) Newnan et al. chapter 6 problem 46.

2. Modify the mortgage backed security spreadsheet to answer the following questions. The three parts to this problem are independent of each other. *Do not show your work and do not turn in the spreadsheet.*
 - a) Write a couple sentences describing what happens to the losses (both average and standard deviation) as you vary the default probability and the threshold at which the mezzanine tranche takes losses. Be specific (use numbers). A picture or chart would be cool but is not required.
 - b) The federal government is now telling you (the administrator of these mortgages) to renegotiate the mortgages so that they are less likely to go into foreclosure (by reducing the principal and thus lowering the monthly payments to levels people can afford). All together, the pool will end-up with an immediate loss of \$10k for each mortgage due to these changes (this loss is divided equally among two tranches). This renegotiation lowers the probability of defaulting drops to 20%. The homeowners clearly benefit from this change. Does the expected total losses in the pool decrease (count both the losses from the renegotiation and the actual defaults)? Do the investors in the equity and mezzanine tranches benefit?
 - e) We will now add correlation to the simulation. Currently our simulation assumes that defaults among mortgages are independent of each other thus leading investors to believe that there's some averaging or law of large numbers that helps them. In reality though, defaults are correlated: if your neighbor's home is foreclosed, then it is likely that more homes will be foreclosed (because for example the economy might not be so great). So now assume that there's a 60% chance that the economy will be good and a 40% chance it will be bad. If it is good, then the chance of one of these high-risk mortgages defaulting is 40% and if it is bad, then the probability is 65%. You can verify that the overall chance of default is still 50%. How does this change the losses (both on average and standard deviation) for the whole pool, and the two tranches?

3. Suppose that you are the CEO of some big bank. Your buddies on the board of directors have given you a million stock options for your brilliant leadership (you convinced the government to bail out the company) and to give you incentives for further success. The stock price of your company today is $S_0 = \$20$. The stock price a year from now (according to typical financial models) is $S = S_0 \cdot e^Z$ where Z is normally distributed with mean 0.05 and standard deviation 0.2, $Z \sim N(0.05, 0.2^2)$. If the stock price a year from now is below the current price, then the options will be worthless. Otherwise, each option allows you to buy the stock at a price of S_0 . Thus the value of the options equals the increase in the stock price, if it is positive, $\max\{0, S - S_0\}$. Create a simulation with 100 randomly chosen scenarios to answer the following questions.
 - a) What is the expected value and standard deviation of the stock price a year from now?
 - b) What is the expected value and standard deviation of your options a year from now?
 - c) Since you're the CEO, you decide to diversify your investments and buy mortgage backed securities, Facebook stock, and Zynga stock. This changes the distribution of the company's

stock returns. Now, $Z \sim N(-0.03, 0.4^2)$. How does this change the answers to parts a and b? Write a sentence or two describing the change.

4. To absorb some short-term excess production capacity at its Arizona plant, Special Instrument Products is considering a short manufacturing run for either of two new products, a temperature sensor or a pressure sensor. The market for each product is known if the products can be successfully developed. However, there is some chance that it will not be possible to successfully develop them. Revenue of \$1,000,000 would be realized from selling the temperature sensor and revenue of \$400,000 would be realized from selling the pressure sensor. Both of these amounts are net of production cost but do not include development cost. If development is unsuccessful for a product, then there will be no sales, and the development cost will be totally lost. Development cost would be \$100,000 for the temperature sensor and \$10,000 for the pressure sensor. Suppose that the probability of development success is 0.5 for the temperature sensor and 0.8 for the pressure sensor. Which, if either, of these products should Special Instrument Products attempt to develop? Construct the decision tree and solve it. Make sure to label the nodes. Don't forget the probabilities. Write a sentence explaining the optimal strategy.

5. This problem is set in 1980. ABC Computer Company is considering submission of a bid for a government contract to provide 10,000 specialized computers for use in computer-aided design. There is only one other potential bidder for this contract, Complex Computers, Inc., and the low bidder will receive the contract. ABC's bidding decision is complicated by the fact that ABC is currently working on a new process to manufacture the computers. If this process works as hoped, then it may substantially lower the cost of making the computers. However, there is some chance that the new process will actually be more expensive than the current manufacturing process. Unfortunately, ABC will not be able to determine the cost of the new process without actually using it to manufacture the computers. If ABC decides to bid, it will make one of three bids: \$9,500 per computer, \$8,500 per computer, or \$7,500 per computer. Complex Computers is certain to bid, and it is equally likely that Complex will bid \$10,000, \$9,000, or \$8,000 per computer. If ABC decides to bid, then it will cost \$1,000,000 to prepare the bid due to the requirement that a prototype computer be included with the bid. This \$1,000,000 will be totally lost regardless of whether ABC wins or loses the bidding competition. With ABC's current manufacturing process, it is certain to cost \$8,000 per computer to make each computer. With the proposed new manufacturing process, there is a 0.25 probability that the manufacturing cost will be \$5,000 per computer and a 0.50 probability that the cost will be \$7,500 per computer. Unfortunately, there is also a 0.25 probability that the cost will be \$8,500 per computer. Should ABC Computer Company submit a bid, and if so, what should they bid per computer? Construct the decision tree and solve it. Make sure to label the nodes. Don't forget the probabilities. Write a sentence explaining the optimal strategy.