Hwk 4 Decisions

Due in class on Friday 1/23.

(The assignment is currently incomplete. I will add more problems later.) You may work in groups of up to 3 people.

Problems 1-2 are from Engineering Economic Analysis by Newnan, Lavelle, and Eschenbach. Problem 3 is from Finance 440 at Kellogg.

1) An industrial park is being planned for a tract of land near the river. To prevent flood damage to the industrial buildings that will be built on this low-lying land, an earthen embankment can be constructed. The following data has been gathered:

Embankment Heigh Above Roadway (m)	**Initial Cost ($1000s)**
2.0	100
2.5	165
3.0	300
3.5	400
4.0	550

Flood Level Above Roadway (m)	**Average Frequency that Flood Level Will Exceed This Height**
2.0	Once in 3 years
2.5	Once in 8 years
3.0	Once in 25 years
3.5	Once in 50 years
4.0	Once in 100 years

The embankment can be expected to last 50 years and will require no maintenance. Whenever the flood water flows over the embankment, $300,000 of damage occurs. Should the embankment be built? If so, to which of these five heights? A 12% rate of return is required.

2) A factory building is located in an area subject to occasional flooding by a nearby river. You have been brought in an as a consultant to determine whether flood-proofing of the building is economically justified. The alternatives are as follows:

A. Do nothing. Damage in a moderate flood is $10k and in a severe flood, $25k.

B. Alter the factory at a cost of $15k to withstand moderate flooding without damage and withstand severe flooding with $10k damages.

C. Alter the factory building at a cost of $20k to withstand a severe flood without damage.

In any year the probability of flooding is as follows: 0.7 no flooding; 0.2 moderate flooding; and 0.1 severe flooding. If interest is 15% and a 15 year analysis period is used, what do you

recommend?

3) Upon graduation, you land a job with a $120,000 salary. The firm also happens to know that your favorite car is the BMW 745i. So to sweeten the deal, the firm also offers to give you $34,000 in cash towards the purchase of the car, or to reimburse you for five years of monthly payments if you lease the car. (Ignore tax implications.)

If you buy the car: The price of the car is $66,000. You're still short on cash, so if you want to purchase the car, you have to borrow at 10% (the quoted annual percentage rate) by taking out a five-year annuity loan with monthly payments. The loan payments are at the end of each month.

If you lease the car: The monthly lease payments are $700 for five years. The contract stipulates that at end of the lease you can either purchase the car for $36,000 or walk away. As is the usual practice, the lease payments are at the beginning of each month.

Assume that you know with certainty that you will work for the firm for at least five years, and that you will be able to sell the car for $38,000 at the end of the lease term. You can borrow or lend at an annual rate of 10% (monthly compounding).

a) Ignoring the firm's offer, would it be cheaper for you to lease or to purchase the car with a loan if you plan to keep the car for at least five years?

b) Now consider the firm's offer. Should you take the $34,000 cash or the $700 monthly reimbursements?

4) Consider a pool of 100 extremely risky mortgages (or this could be the mortgages most at risk of defaulting from a much larger pool). The economy being what it is, each mortgage in this pool has an independent 50% probability of defaulting (where the house goes into foreclosure). For each default, creates a $100k loss for investors.

a) What is the expected size of the combined losses in the pool? What is the standard deviation of the combined losses?

b) This pool is divided into two tranches (or slices). The equity slice absorbs the losses from the first 40 defaults while the mezzanine tranche takes any remaining losses. What is the expected size and standard deviation of the losses in each tranche?

c) Now the federal government is telling you (the administrator of these mortgages) to renegotiate the mortgages so that they are less likely to go into foreclosure (by lowering the monthly payments to levels people can afford). All together, the pool will end-up with an immediate loss of $20k for each mortgage due to these changes. However, the probability of defaulting drops to 30% and each default now creates only an additional $90k loss for investors. 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?

d) Extra credit: incorporate a 50% correlation into this model and then answer a-c again.

5)Suppose that you are the CEO of some big company. Your buddies on the board of directors have given you a million stock options for your brilliant leadership and to give you incentives for further success. The stock price of your company today is \$100. The stock price a year from now (according to typical financial models) is $S = \$100 \cdot e^Z$ where Z is normally distributed with mean 0.05 and standard deviation 0.2, $Z \sim \mathcal{N}(0.05, 0.2^2)$. When the stock options mature a year from now, each will be worth $\max\{0, S - \$100\}$. If the stock price a year from now is below the current price, then the options will be worthless. Otherwise, their worth is equal to the increase in the stock price, $S - \$100$.

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 invest a chunk of your company's money in mortgage CDOs. This changes the distribution of the company's stock returns. Now, $Z \sim \mathcal{N}(-0.03, 0.4^2)$. How does this change the answers to parts a and b?