Midterm 2

1. (12 points) Assume that inflation has been 2% annually. Convert a $100 expense in 2011 to inflation-adjusted 2000 dollars.

Answer: 100/1.02^11 = $80.43

2. (22 points) Your company owns an old copper mine in Bisbee, Arizona that has been closed for years. Since the price of copper is now so high, you decide to reopen the mine. It will cost $4m to reopen the mine (the cost of equipment, permits, etc.). You decide to borrow the necessary $4m from the bank for this endeavor. The bank charges interest i (compounded annually) and requires you to repay the loan with four equal annual payments. You expect an operating profit (revenues minus operating costs but before loan payments) of $1.5m in the first year and $2m in subsequent years. After 10 years the mine will be exhausted. You expect the inflation rate to be f and use a real discount rate of d_R. What is the NPV of the project?

Answer: $d_N = (1+f)(1+d_R)-1$
Annual payment for the loan = 4m*i/(1-(1+i)^-4)
NPV = $1.5m/(1+d_R) + 2m/d_R*(1-(1+d_R)^-9)/(1+d_R) - 4m*i/(1-(1+i)^-4)/d_N*(1-(1+d_N)^-4)$

3. You are developing a better battery for electric cars. It lasts 8 years instead of 5 years. Current batteries cost $15k. Assume inflation is 1% and that your customers use an actual discount rate of 5%.
a) (3 points) What is the real discount rate?
b) (20 points) What is the maximum price that you could charge so that customers would still prefer your battery?

Answer:
a) 1.05 = (1.01)(1+r) => real discount rate = r = 3.96%
b) EUAC for the 5-year battery = 15k*.0396/(1-1.0396^-5) = $3.37k
Max Price for the 8-year battery = 3.37k/.0396*(1-1.0396^-8) = $22.7k

4. A newspaper company ABC Times prints newspapers early in the morning before sending them out. The demand for the newspaper can be either high or low. If the demand is high, 12k of ABC Times can be sold for that day. If the demand is low, 10k of ABC Times can be sold. If you print more than the number that can be sold, you can only sell 12k when the demand is high and 10k when the demand is low, and any extra remaining newspaper is thrown away. If you print less than the number that can be sold, you can only sell the number that you have printed. Suppose that low demand occurs with probability 0.1, and the high demand occurs with probability 0.9. The normal production level is to print 10k newspapers for the day. The manager can decide whether to switch to the enhanced production level to print 12k newspapers or keep it at the normal level of printing 10k newspapers. However, if the enhanced production level is used, there is 30% chance that the equipment malfunctions that day which costs $3k to call an express repairman who stays until all 12k newspapers are printed. Suppose that

the cost of printing newspapers is negligible ($0) and that one newspaper can be sold for $1.

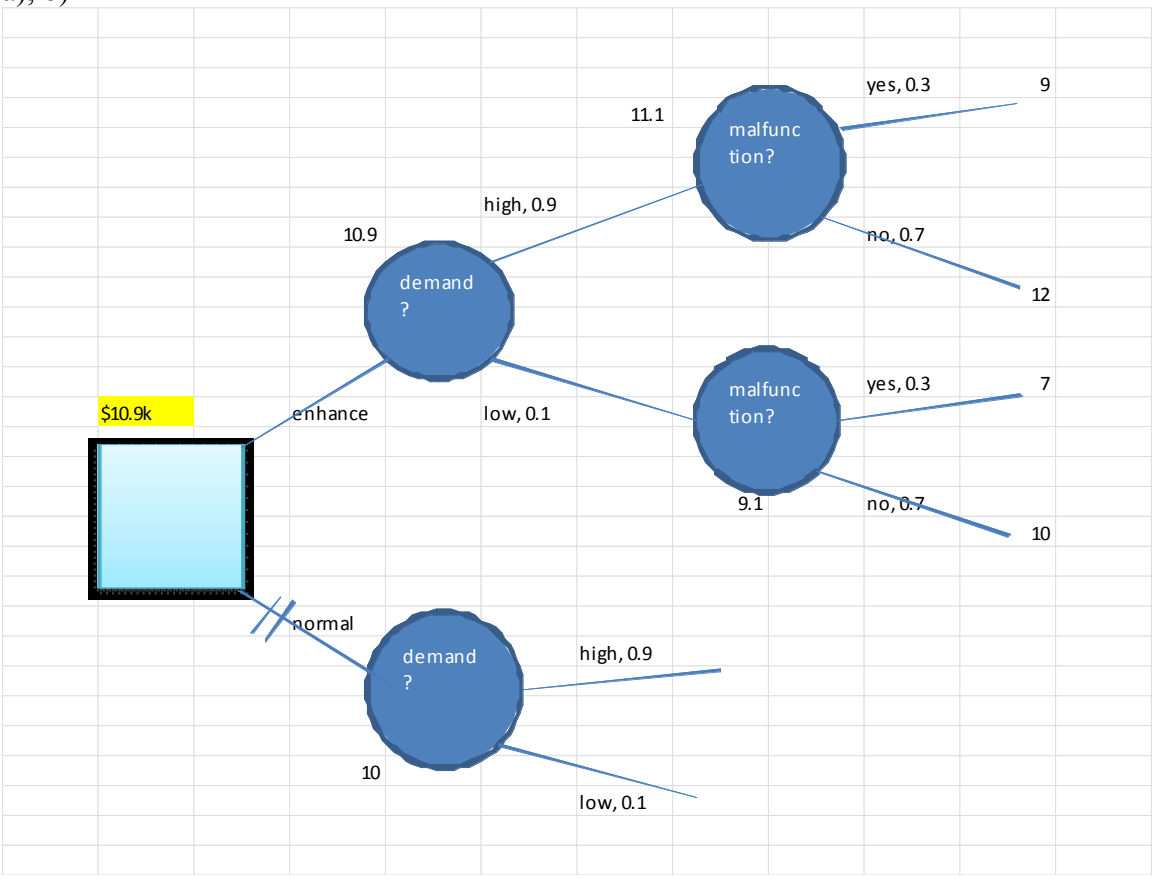
a) (*11 points*) Construct the decision tree. Make sure to label the nodes. Don't forget the probabilities.

b) (*7 points*) Solve the decision tree. Make sure to prune the sub-optimal branches and label each node with its payoff. (*Hint: there is no discounting in this problem.*)

c) (*5 points*) Write a sentence mentioning the expected profit and explaining the optimal strategy.

Answer:

a), b)



c) The expected profit is $10.9k. The optimal strategy is to print at the enhanced production level.

5. (20 points) This is a continuation of the previous problem with the following changes:

1) The equipment won't malfunction.

2) The enhanced production level (for printing 12k copies) costs $1k.

3) Now the company makes a prediction of demand before printing the newspapers. Instead of using numerical values, consider the random variables *A* (for actual demand) and *F* (for forecast demand).

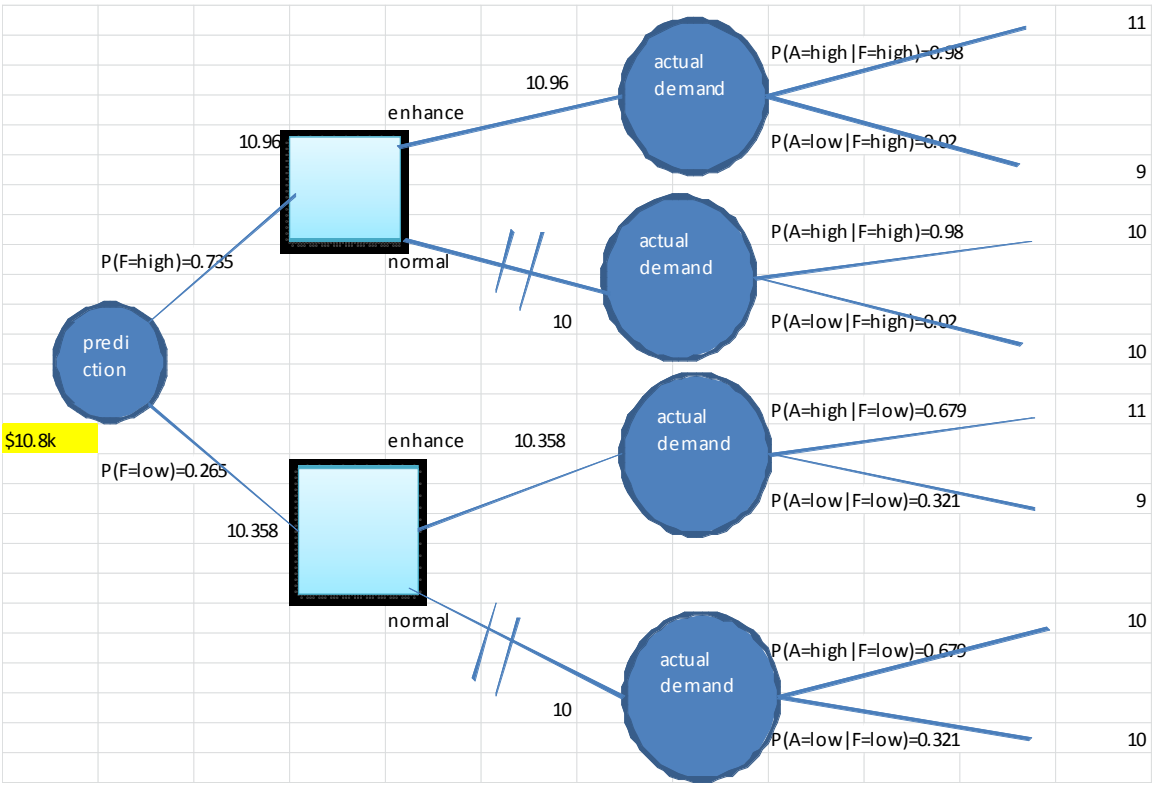
a) (*14 points*) Construct the decision tree. Make sure to label the nodes. Don't forget the probabilities. Since you don't have numerical values for the probabilities, you'll have to describe them using notation such as P(A=low | F=high) or P(F=high | A=low) etc.

b) (*6 points*) Now suppose that there is a 0.2 probability that the prediction is low demand when the actual demand is high and that there is a 0.15 probability that the prediction is high demand when the actual demand is low. Calculate the numerical values of the probabilities you need in part a.

c) (*6 points extra credit*) Solve the decision tree with the numerical probabilities calculated in part b. Make sure to prune the sub-optimal branches and label each node with its payoff. (*Hint: there is no discounting in this problem.*)

d) (*4 points extra credit*) Write a sentence mentioning the expected profit and explaining the optimal strategy.

Answer:
a)b)c)



d) The expected profit is $10.8k. The optimal strategy is to print at the enhanced production level for both low and high forcasts.