

STA371G: Homework 2

Instructions (read carefully!)

Submit your assignment as a **single** PDF or Word document to Canvas by **Friday Sept 22 at 7:00PM**. Pictures or scans of handwritten work are acceptable, but it is your responsibility to make sure that the document you upload is complete, legible, and uncorrupted.

Grading

A small number of the problems on each assignment will be graded for correctness, and the remainder graded for completeness. A complete response answers the question posed and also shows your work. This means showing the steps of a mathematical calculation, or including the R code you used to arrive at your answer. For questions that are not just calculations (e.g., more than computing an expected value from a table) you should answer in complete, concise sentences. Detailed solutions will be available – you should always check your work against these solutions.

Problem 1: Freemark Abbey Winery (I)

This problem is based on the Freemark Abbey Winery case. Please read this case carefully before answering the following questions. You should assume that Freemark Abbey Winery sells the wine in bulk at \$1 per bottle if the storm hits and there is no mold. Assume that the winery produces 1,000 cases of 12 bottles each (unless there is mold - see the case for the appropriate volume under that outcome). Use units of thousands of dollars (so that a payoff of 10 below corresponds to the winery making \$10,000).

1. Fill out the payoff table below using the information given in the case.

Table 1: Payoff Table

	Storm Botrytis	Storm No Botrytis	No Storm Sugar 25%	No Storm Sugar 20%	No Storm Acidity <0.7%
Harvest Now					
Harvest Later					

2. Construct a decision tree using the information given in the case.
3. What is the probability distribution of the possible outcomes **if Jaeger decides not to harvest immediately**? What is the mean of this distribution?
4. What decision would you recommend to Jaeger given the information you have?

5. Would your decision change if the probability changes from 0.4 to 0.2 that the botrytis mold forms given that the storm hits? Why or why not?

Problem 2: Freemark Abbey Winery (II)

In this problem, we will study the value of information for Jaeger.

1. Suppose you could buy perfect information regarding whether or not the botrytis mold forms if the storm hits. Build a new decision tree reflecting the receipt of perfect information about the mold.
2. Compute the expected payoff if Jaeger pays for the perfect information. What is the most Jaeger should be willing to pay for this information?

Problem 3: Freemark Abbey Winery (III)

In problem #2, you computed the expected value of the mold expert’s perfect information regarding whether or not the condition of the grapes is such that the botrytis mold will form if the storm hits. In this problem, we will apply Bayes theorem to find out the expected value of imperfect (sample) information.

Suppose that if the condition of the grapes is such that the mold will form if the storm hits, the mold expert correctly indicates this 75% of the time; and if the condition of the grapes is such that mold will not form if the storm hits, the mold expert correctly indicates this 85% of the time.

1. Fill the joint probability table shown below:

	Mold	No Mold
Expert States Mold		
Expert States No Mold		

2. Construct the new decision tree for the case with imperfect information.
3. Compute the expected payoff if Jaeger pays for the imperfect information. What is the most Jaeger should be willing to pay for the mold expert’s imperfect information?

Problem 4

An oil company has purchased an option to drill on land in Midland, TX. Preliminary geological studies have assigned the following probabilities of finding oil in the land:

$$Pr(\text{high quality oil}) = 0.5 \quad Pr(\text{medium quality oil}) = 0.2 \quad Pr(\text{NO oil}) = 0.3$$

After buying the option the company decided to perform a soil test. They found soil “type A”. Conditional probabilities of finding this particular type of soil are as follows:

$$Pr(\text{soil} = \text{“type A”} | \text{high quality oil}) = 0.2$$

$$Pr(\text{soil} = \text{“type A”} | \text{medium quality oil}) = 0.8$$

$$Pr(\text{soil} = \text{“type A”} | \text{NO oil}) = 0.2$$

1. Given the information from the soil test what is the probability the company will find any kind of oil in this land?
2. It will cost \$1,000,000 to drill and start operating a well. In addition, under current oil prices, the oil company assesses that if oil is found (of any kind) the revenue stream will be \$1,500,000. Meanwhile, a competitor has offered to pay \$220,000 for the option. Should the oil company exercise the option (i.e., drill), or sell the option to the competitor?