

# Business Decision Analytics under Uncertainty

## Spring 2017, Professor Eckstein

### Homework 1

**Due Wednesday, February 1**

Show your work, including a completed decision tree, for each problem.

#### **Q1: Strategy for a game show**

Problem 8 on pages 65-66 of the textbook. State the optimal policy and its expected earnings. At the outset, assume that you have the option of refusing to play the game at all.

#### **Q2: Purchasing a plane ticket**

Problem 7 on page 65 of the textbook. State the optimal policy and its expected cost.

#### **Q3: Making a loan**

Problem 1 on page 72 of the textbook. Show all your work computing the probabilities needed by the decision tree. State the optimal policy and its expected profit. Find the EVSI of investigating the customer's credit record. Also, find the EVPI for this situation.

#### **Q4: Quality control testing**

Your firm produces advanced high-power rotating magnets used in medical imaging equipment, typically producing about 10 magnets per day. The production procedure is delicate, and each completed magnet must pass two stringent quality tests, called A and B, before being shipped. Each test has only two possible outcomes, pass and fail. You recently performed both tests on a large sample of magnets, and observed the following frequencies of test outcomes:

	Pass A	Fail A
Pass B	77%	3%
Fail B	11%	9%

That is, 77% of magnets passed both tests, 3% passed B but failed A, 11% passed A but failed B, and 9% failed both.

Performing test A costs \$500, and performing test B costs \$600. A magnet that fails either test must go through a repair process before being shipped, which adds \$5,000 to its manufacturing costs. Now that you have completed collecting the sample data summarized above, you route magnets to this repair process as soon as you know they have failed either test. That is, if a magnet fails test A but you have not yet performed test B, you immediately send it into the repair process without bothering to find out if it also fails test B, and vice versa. Magnets going through the repair process do not have to be tested again.

The plant manager is unsure how to set up the quality assurance area of the production line: should magnets first undergo test A, and then those that pass undergo test B? Or should the magnets first undergo test B, and then those that pass undergo to test A? Use a decision tree to answer this question, assuming that the probabilities of passing and failing the two tests remain the same as in the sample described in the table above. What is the average cost per magnet?