# Lab 2

## More Data-Driven Decision Making and Bayes’ Theorem

## Introduction

In this practical, we will attempt to recommend the optimal decision using **expected value approach.**

1. A company is planning a plant expansion. They can build a large or small plant. The payoffs for the plant depend on the level of consumer demand for the company's products. The company pays a market research firm to survey consumer attitudes towards the company's products. The results of the market research shows that there is a **63% chance that the customers will like** the products and a **37% chance that they won't**. The payoff matrix and costs of the two plants are listed below. The company believes that **if the survey is favorable there is a 92% chance that demand will be high** for the products. If the **survey is unfavorable there is only a 30% chance that the demand will be high**.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Demand | |  |
| Factory Size | High | Low | Plant Cost ($mil) |
| Large | 200 | 85 | 10 |
| Small | 100 | 95 | 2 |

Use Tree Plan to draw the decision tree to derive the optimum decision using expected value approach.

Give:

P(Favorable Report) = 0.63

P(Unfavourable Report) = 0.37

P(High Demand | Favourable report) = 0.92

P(High Demand | Unffavourable Report) = 0.08

Can we find the following?

P(Low Demand | Favourable) =

P(Low Demand | Unfavourable Report) =

Draw Dec Tree

Recommendation: To build large plant.

1. An investor is considering 4 investments, A, B, C, D. The payoff (in thousands of $) from each investment as a function of the economic climate over the next 2 years is shown below. The economy can be expanding or declining. The investor has estimated the probability of a declining economy at 25% and an expanding economy at 75%.

|  |  |  |
| --- | --- | --- |
|  | Economy | |
| Investment | s1: Expand | s2: Decline |
| A | 40 | 30 |
| B | 35 | 45 |
| C | 45 | 30 |
| D | 35 | 40 |

Draw the decision tree to derive the optimum decision using expected value approach.

Invest in C.

1. Based on the scenario given in Q2, consider now that a market study of the stock market is expected to report either a favorable (*F*) or unfavorable (*U*) condition. The relevant conditional probabilities are as follows: P(*F* | s1) = 0.70, and P(*U* | s2) = 0.80. Using Bayes’ Theorem, find the revised/posterior probabilities that incorporates this market study.

S1 = Economy Expanding, S2 = Economy Declining

Given:

P(F | S1) = 0.70

P(u | S2) = 0.80

P(S1) = 0.75

P(S2) = 0.25

Can we find:

P(U | S1) =

P(F | S2) =

1. Based on the revised probabilities you have found, draw a new decision tree. What is the new optimum decision on which stocks to buy? What is the final expected value?