**Assignment 1: Decisions Under Uncertainty**

BUAD 5032 – Fall 2021

1. **Objective:**

The purpose of this assignment is to build spreadsheet models in Excel that help with making decisions under uncertainty.

1. **What You Will Need**

Access to a computer with Excel.

1. **What You Will Hand In**

Submit the workbook that you create (Assignment1FirstnameLastname.xlsx) via Blackboard - Assignment 1.

You should use one worksheet per problem.

1. **Due Date**

10/11/2021 at 11:59PM EST.

1. **Note on Collaboration**

This is a *Category A* assignment. Specifically, you may not receive help from anyone on this assignment except the professor. It must be 100% your own work. All questions concerning this assignment must be addressed to your professor. It is an honor code offense to give or receive any assistance on these assignments.

1. **General Instructions**

Complete all questions.

Use text boxes to answer each question and make use of complete sentences.

Use color to highlight your inputs, decision variables, calculated fields and optimal values.

DO NOT HARD CODE VALUES OTHER THAN INPUTS.

**Problem 1: Using Decisions Trees and Expected Monetary Value (50%)**

An investor with 10,000 available to invest has the following options: (1) he can invest in **a risk-free savings account with a guaranteed 3% annual rate of return**; (2) he can invest in a fairly safe stock where the possible annual rates of return are 6%, 8% or 10%; or (3) he can invest in a riskier stock, where the possible annual rates of return are 1%, 9%, or 17%. The investor can place all his available funds in any one of these options, or he can split 10,000 into two $5000 investments in any of two of these options. The joint probability distribution of the possible return rates for the two stocks is given in the table below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | **Risky stock return (R)** | | |
|  |  | R=1% | R=9% | R=17% |
| **Safe stock return (S)** | S=6% | 0.10 | 0.05 | 0.10 |
| S=8% | 0.25 | 0.05 | 0.20 |
| S=10% | 0.10 | 0.05 | 0.10 |

1. First consider the strategy of investing the 10,000 into a single option. Should the investor put his money in the risk-free investment, the safe stock, or the risky stock? Make sure you calculate the expected returns for each option and make use of the joint probability table above.
2. Consider now the scenario where the investor can invest $5000 in any of two of these options (i.e. 1, 2, or 3). Which two investments should the investor choose? Make sure you make use of the joint probability table above.
3. Now consider a) and b) together, what should the investor do to earn the highest expected monetary value? How robust are your findings to changes in the amount available to invest (10,000) and the risk-free rate of return (3%)?
4. Discuss how the investor’s attitude towards risk might change the solution found in a). Use the utility function to show that when R is low enough the investor will now favor a safer investment. At what level of R is the investor indifferent between the safe investment and the risky investment? (Avoid the trivial solution).

**Problem 2: Updating Probabilities Using Bayes’ Theorem and the Value of Information (50%)**

A customer has approached a bank for a $100,000 one-year loan at an 8% interest rate. If the bank does not approve this loan application, the $100,000 will be invested in bonds that earn a 6% annual return. Without additional information, the bank believes that there is a **4% chance that this customer will default** on the loan, assuming that the loan is approved. If the customer defaults on the loan, the bank will lose $100,000. At a cost of $1000, the bank can thoroughly investigate the customer’s credit record and supply a favorable or unfavorable recommendation. Experience indicates that the probability of a **favorable recommendation for a customer who will eventually not default is 0.80,** and the chance of a favorable recommendation for a customer who will eventually default is 0.15.

1. What should the bank do?
2. Will the bank change its decision if the customer had a 2% chance of defaulting?
3. Return to a chance of defaulting of 4%, what is the Expected Value of Information for this problem?
4. Return to a chance of defaulting of 4%, what is the Expected Value of Perfect information for this problem?