Final Project Decision Analysis

Task 1: A decision problem (8p)

Cash-Without-Borders A multi-national fintech company which offers payment solutions for private consumers as well as small- to medium-enterprises considers lowering their cost of technical support.

The payment solution company has the strategy of offering payments transfers quick and in a hassle-free way.

For technical support, the company consider the strategies: keep the support in-house as before, outsource to a call-centre in a third country or apply a specially trained chat-bot.

The advantage of having the support in-house is that the company will lose high-value clients if the service becomes worse.

a. Do a SMART-analysis of the problem as described in Chapter 3, *Decisions involving multiple objectives* in the book *Decision Analysis for Management Judgment* on eStudy. Be sure to include a *value-tree* for the problem. (3p)
b. Briefly describe how you would go about to estimate the costs and risks of the activities in you value-tree. (2p)
c. Explain how you would find the maximum expected monetary value of the three main strategies in this case. Demonstrate your solution (either with a probability tree or through a Monte-Carlo simulation) on pen and paper or with Python code. In the answer you are required to show how you have attributed costs and risks (either probabilities or distribution of probabilities) for each uncertain cost. You should also give (made-up) monetary costs for each strategy. (2p)
d. In your model, which strategy is best? How sensitive is your solution to your assumptions? (1p)

Task 2: Fine-tuning a model (12p)

In the code Backpropagation 1 there is an example of a [4,5,2] network used to predict the outcome of the variable `survived` from the features `'pclass', 'sex','age','sibsp'` in the dataset `Titanic Dataset.csv`

a. How well is this network performing compared to logistic regression? (3p)
b. Adapt the code so that you can use 5 input variables and add one variable of your choice. Did you perform better? What is the best layout of the network? (5p)

c. Why do we have two output nodes? What happens if you just use one? Can you adapt a network with just one output node to this problem? (2p)
d. Adapt the code so that it can run batches or mini batches. For an example, see solutions to Homework 3! (2p)

Task 3: Recognizing handwritten numbers (10p)

Adapt the code in Backpropagation 1 to the task of recognizing the digits in MNIST dataset. In the data there are n= 60,000 examples. I suggest to create a network with [784, N, 10] layers.

a. Why are 784 layers appropriate for the input layer? (2p)
b. Why are 10 layers appropriate for the output layer? Are there other options? (3p)
c. Run a backpropagation algorithm on a smaller subset of the 60,000 examples and try to find reasonable value on the learning rate as well as the size of the hidden layer. (3p)
d. Run the backpropagation algorithm on the entire data-set, how well is it performing?

Hand in a 3 documents per group. Example code should be run and the output should be in the document.