Chapter 10 Electronic Supplement by Tan and Anderson

This archive contains the files that are used to create the examples in Chapter 10. Specifically, the contents include system dynamics model and sensitivity files (in Vensim®), decision tree files (in DPL®), Macro-enabled Excel template files with embedded VBA programs, and other Excel files (some with embedded @Risk functions) to calculate the middle steps of the algorithms.

Contents

ReadMe.pdf

This file.

System Dynamics Model Files (folder)

Chapter 10 analyzes two different versions of a renewable energy capital investment model. This folder contains the Vensim® files for the corresponding SD models as well as the sensitivity analysis files.

Chapter10-SDModel.mdl

Vensim® model file for the base model analyzed in Section 10.3.

Chapter10-ModifiedSDModel.mdl

Vensim® model file for the modified version analyzed in Section 10.4.

sens3.vsc

The file that contains the list of uncertain variables and their distributions for the Monte Carlo simulation of the SD model

final.lst

The list of output variables for the Monte Carlo simulation

newbatchfile.cmd

Vensim script file to run different decision sequences of the project model automatically. The file contains the changes to be made in the model for each decision sequence.

Excel Template Files with VBA code (folder)

This folder includes the Macro-enabled Excel template files to calculate the discrete distribution approximations for the SD-based decision tree algorithm. There are two templates because the code is different when the decision sequence starts with "Invest" (in which case, use "templateIEE.xltm") versus when it starts with "Delay" (in which case, use "templateDIE.xltm").

templateIEE.xltm

Macro-enabled Excel template file to calculate the discrete distribution approximations for the continous cash flow distribution obtained from the SD model. Used for the decision sequences that start with the decision "Invest" (see Table 10.3).

templateDIE.xltm

Macro-enabled Excel template file to calculate the discrete distribution approximations for the continous cash flow distribution obtained from the SD model. Used for the decision sequences that start with the decision "Delay" (see Table 10.3).

Decision Tree Files (folder)

This folder includes the decision tree files created in DPL® for the examples in Chapter 10.

SD-basedDecisionTreeApproach.da

The DPL® file for the *SD-based decision tree algorithm* corresponding to the base model in Section 10.3.

SD-basedDecisionTreeApproach-ModifiedModel.da

The DPL® file for the *SD-based decision tree algorithm* corresponding to the modified model in Section 10.4.

DiffusionApproximationApproach.da

The DPL® file for the *diffusion approximation approach* corresponding to the base model.

DiffusionApproximationApproach-ModifiedModel.da

The DPL® file for the *diffusion approximation approach* corresponding to the modified model.

Diffusion Approximation Algorithm Files (folder)

This folder includes the files to calculate the middle steps of the diffusion approximation algorithm.

CalculationForPVandCashFlowPayout.xlsx

This file is used to estimate the present value (PV) of the cash flow, the remaining project value (V_t) for period *t* as defined in Equation 10.1, and the cash flow payout rate (δ_t) as defined in Equation 10.2.

FileToSimulateGBMprocess.xlsx

This file uses the software @Risk to simulate a Geometric Brownian Motion (GBM) process using the PV, and δ_t calculated in the file CalculationForPVandCashFlowPayout.xlsx. The analyst has to enter a

value for volatility (sigma) to simulate the process. The goal is to simulate GBM processes for different values of volatility and then finding the volatility that minimizes the difference between the GBM process and the cash flow distribution obtained from the SD model.

CalculationForVolatilityEstimation.xlsx

This file includes a template to estimate the volatility of the GBM approximation. Specifically, for different values of volatility, the file compares the 10^{th}, 50^{th}, and 90^{th} percentiles of the GBM approximation and the cash flow distribution from the SD model. Then, the squared errors are calculated and summed. The volatility that gives the minimum total squared error is chosen. Note that this is not an automated process. The analyst has to obtain the GBM percentiles for each value of volatility one by one using the "FileToSimulateGBMprocess.xlsx" template and then paste the data into the corresponding worksheet.