**Mathematical models and simulations in Excel: the case**

**of the Marion Investment Company**

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**INTRODUCTION**

Mathematical models use a system of mathematical relationships and expressions to represent problems. Simulations allow decision makers to learn about a real system by experimenting with mathematical models that represent that system. Typical simulators allow decision makers to assign specific values to control variables and then use random number generators to assign probabilistic inputs. Decision makers can then assess the outcomes of various sets of inputs. The models and simulators presented in this case are designed to introduce students to model and simulator creation, use, and assessment. In addition, the case is intended to demonstrate how simulators that use probabilistic inputs may provide different outcomes than simpler models that use only control variables.

The Marion Investment Company case assumes students have basic MicroSoft Excel skills, including the ability to input simple mathematical expressions, interpret and create nested IF functions , and use the FV and RAND functions.

**LEARNING OBJECTIVES**

1. Students will be able to use Excel spreadsheets to create mathematical models and simulations.
2. Students will be able to use simulations to perform what-if analysis.
3. Students will be able to use simulations to perform risk analysis and evaluate alternatives.

**OVERVIEW**

Welcome to the Marion Investment Company (MIC). MIC specializes in long-term personal retirement planning and wealth management. MIC specializes in helping families achieve financial security.

Typically, MIC seeks clients with above-average financial savvy. However, as a result of the economic downturn that began in 2008, MIC began to target the large market of individuals and families with relatively little knowledge of personal finances or investing. Company research and interviews with top partners and salespeople indicate that the investment decisions of clients with little to no investing experience are often strongly influenced by simple demonstrations of various investment strategies and their expected outcomes. As a result, the company has developed a set of Microsoft Excel worksheets that are intended to be tools for salespeople to use during sales calls to customers. The worksheets allow salespeople to demonstrate to customers how various dollar amounts, invested at various levels of expected return (and risk) accumulate wealth over time.

Assume that you are a recent hire at MIC, and that part of your training involves learning the new simulation tool. Once you have mastered the tool, you should be able to do the following:

1. Show customers the expected return on simple investment models. Such models assume constant returns over long periods of time.
2. Show customers the expected returns on more complex investment simulations. Such models assume that investment returns will vary from year to year.

The simulator tool created by MIC, and a tutorial intended to familiarize you with the simulator, will be provided to you by your managing partner (in this case, your instructor). Please download the Microsoft Excel file “financial\_simulations\_workbook.xlsx)” and the Microsoft Word file “marion\_workbook.docx”, and proceed through the instructions in the file “marion\_workbook.docx”.