

Section 1

The Structure of the Course, the Delphi Method, the Purpose of MCS and its Background

Lecture 1

The Structure of this Course

Agenda

- A. Description of the Course
- B. Probability Distributions used in this Course
- C. Why are we using Excel in this Course?
- D. What about VBA?
- E. What do we Need to Know?
- F. The Resources Folder
- G. Contacting the Instructor

We will refer to

Monte Carlo Simulation as MCS

A.

This is the structure of
our current Course:

5 Sections with
36 Lectures

(Due to their length,
some lectures will be
presented in 2 parts)

Lectures	
Section 1: Introducing Monte Carlo Simulation and the Course	
1.1	The Structure of this Course and Coming Courses
1.2	The Delphi Method - A Manual Simulation
1.3	The Purpose of Monte Carlo Simulation (MCS)
1.4	The Background of Monte Carlo Simulation
Section 2: Probability, Random Numbers, Random Variables and Normal Distributions	
2.1	Applied Probability (Parts 1 and 2)
2.2	Random Numbers, Generation and their Application
2.3	Random Variables and Distributions (Parts 1 and 2)
2.4	Applications of the Normal Distribution (Parts 1 and 2)
Section 3: Introducing the 8-Step Simulation Process and the Case Model	
3.1	Introducing the 8-Step Simulation Process and the Case Model
3.2	Good Modeling Practices and Some Do's and Don'ts
Section 4: The 8-Step Simulation Process Using the Case Model	
4.1	Step 1: Preliminary Simulation Activities
4.2	Step 2: Analyze the Input Variables and Identify their Distributions (Parts 1 and 2)
4.3	Step 3: Develop the Dynamic Model
4.4	Step 4: Analyze the Results - Develop the Frequency Table
4.5	Step 5: Analyze the Results - Develop the Analytic Combo Chart
4.6	Step 6: Analyze the Results - Develop Related Statistics (Parts 1 and 2)
4.7	Step 7: Analyze the Results - Sensitivity and Influence Analysis
4.8	Step 8: State your Findings and Extend the Simulation Model
Section 5: Typical Monte Carlo Simulation Models	

The Numbering of Lectures

Udemy uses a single sequence for all lectures so you will see our lectures numbered from 1 to 36

However, we will use a Dual Level number

LX.Y where X is the Section number and Y the lecture number
Y will always start from 1 within a specific section

Examples: L1.1 (this lecture) or L3.2 or L5.18 (the last lecture)

Section 1

Section 1: Introducing Monte Carlo Simulation and the Course

1.1	The Structure of this Course and Coming Courses
1.2	The Delphi Method - A Manual Simulation
1.3	The Purpose of Monte Carlo Simulation (MCS)
1.4	The Background of Monte Carlo Simulation

Section 2

Section 2: Probability, Random Numbers, Random Variables and Normal Distributions

2.1	Applied Probability (Parts 1 and 2)
2.2	Random Numbers, Generation and their Application
2.3	Random Variables and Distributions (Parts 1 and 2)
2.4	Applications of the Normal Distribution (Parts 1 and 2)

Section 3

Section 3: Introducing the 8-Step Simulation Process and the Case Model	
3.1	Introducing the 8-Step Simulation Process and the Case Model
3.2	Good Modeling Practices and Some Do's and Don'ts

Section 4

Section 4: The 8-Step Simulation Process Using the Case Model	
4.1	Step 1: Preliminary Simulation Activities
4.2	Step 2: Analyze the Input Variables and Identify their Distributions (Parts 1 and 2)
4.3	Step 3: Develop the Dynamic Model
4.4	Step 4: Analyze the Results - Develop the Frequency Table
4.5	Step 5: Analyze the Results - Develop the Analytic Combo Chart
4.6	Step 6: Analyze the Results - Develop Related Statistics (Parts 1 and 2)
4.7	Step 7: Analyze the Results - Sensitivity and Influence Analysis
4.8	Step 8: State your Findings and Extend the Simulation Model

Section 5

Section 5: Typical Monte Carlo Simulation Models	
5.1	Showroom Discount Analysis
5.2	Interviewing Passengers at an Airport (GEOMETRIC)
5.3	Supplier Bidding Model
5.4	Simulating a Project's Critical Path
5.5	Projection of Income Statement Indicators
5.6	Calculating PI with Monte Carlo Simulation
5.7	Assessment of Lab Test Work Load (Dual Level Simulation)
5.8	Summer Fashion Sales Analysis
5.9	Fabric Production Quality Control and Compensation to Customers
5.10	Truck Loading (Single Server)
5.11	Door-to-Door Salesman Success Rate
5.12	Evaluating Projects, Investments and Companies
5.13	Risk Analysis in Projects and Processes
5.14	Batch Production Management (Dual Level Simulation)
5.15	Hotel Reservations with No Show Management
5.16	Credit Risk Modeling
5.17	Weighted Index Scoring Method for Selection of Items
5.18	Staff Turnover Analysis

We use a Variety of Probability Distributions in this Course

Each one is introduced in the Lecture where it first appears

Animation of the Distributions and examples will be given then

This Excel sheet is found in the Resources Folder

Distributions	Lectures	
Dual Level Simulation	5.7	Assessment of Lab Test Work Load (Dual Level Simulation)
	5.14	Batch Production Management (Dual Level Simulation)
Beta	5.4	Simulating a Project's Critical Path
	5.8	Summer Fashion Sales Analysis
	5.14	Batch Production Management (Dual Level Simulation)
	5.16	Credit Risk Modeling
	5.18	Staff Turnover Analysis
Binomial	5.1	Showroom Discount Analysis (Parts 1 and 2)
	5.15	Hotel Reservations with No Show Management
Chi-Square Distribution	5.7	Assessment of Lab Test Work Load (Dual Level Simulation)
Exponential	5.1	Truck Loading (Single Server)
Geometric	5.2	Interviewing Passengers at an Airport
LogNormal	5.2	Credit Risk Modeling
Negative Binomial	5.1	Door-to-Door Salesman Success Rate
Normal	2.4	Applications of the Normal Distribution
	5.3	Supplier Bidding Model
	5.5	Projection of Income Statement Indicators
	5.8	Summer Fashion Sales Analysis
	5.12	Evaluating Projects, Investments and Companies
	5.13	Risk Analysis in Projects and Processes
	5.14	Batch Production Management (Dual Level Simulation)
	5.16	Credit Risk Modeling
	5.17	Weighted Index Scoring Method for Selection of Items
	5.18	Staff Turnover Analysis
Poisson	5.9	Fabric Production Quality Control and Compensation to Customers
	5.10	Single Server Truck Loading
Uniform, Discrete	4.2	Analyze the Input Variables and Identify their Distributions
	5.5	Projection of Income Statement Indicators
	5.12	Evaluating Projects, Investments and Companies
	5.17	Weighted Index Scoring Method for Selection of Items

B.

Why are we using Excel in this Course?

We will be providing many Simulation Models all developed in Microsoft Excel

Yet, there are other two other ways for modeling Monte Carlo Simulation that do not rely on Excel

Group 1: Use Dedicated Off-the-Shelf MCS Tools

ModelRisk from Vose Software BVBA

@RISK from Palisade Corporation

Crystal Ball from Oracle

RiskSolver from Frontline Systems

Group 2: Programming the Models

MCS models can be developed using programming languages such as Python, R and other languages

So Why use Excel?

Although many models can be well developed with Excel, our objective is primarily “educational”

The purpose of this course is to master the fundamental principles, methods and practices of MCS

We will most likely not reach that goal using programming languages or off-the-shelf tools

(Refer to the **References and Credits** document for the Microsoft web page that defines the specs (limits) of Excel 365)

Rationale for using Excel

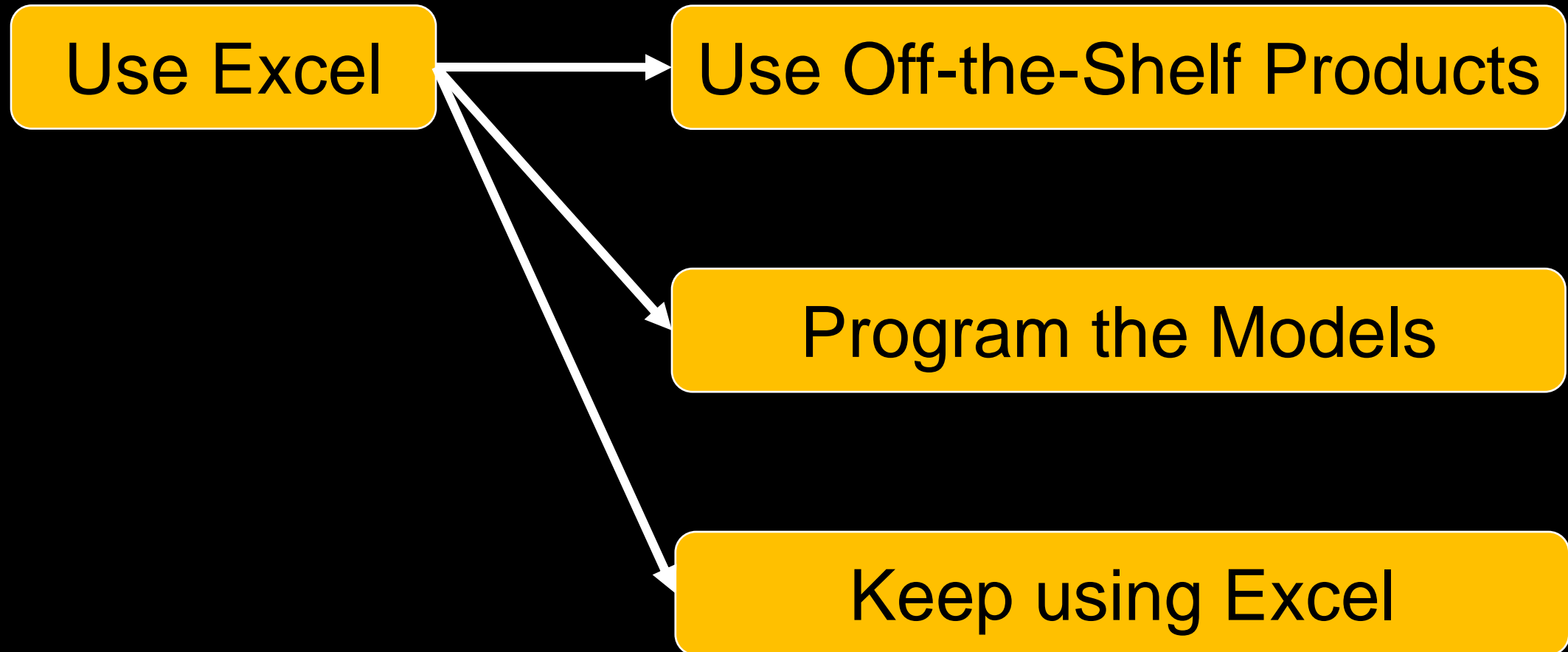
- 1) Most analysts have a good working knowledge of Excel
- 2) Excel is a flexible modeling tool that allows you to experiment with your model, hence make it easier to learn MCS with Excel
- 3) Excel has a diversity of Statistical/Mathematical/Logic functions
- 4) Any function that does not come with Excel can easily be programmed with VBA (Visual Basic for Applications)
- 5) Excel is interfaced with a variety of related applications:
Power BI / Power QUERY / Power PIVOT / Access
- 6) Excel is also interfaced with a variety of large applications such as Collaboration tools (SharePoint) or ERP(Microsoft Dynamics)

Conclusion:

Excel is **flexible** to use and **versatile** in its features.

It is **easy** to learn and easy to **share**

Stages for Applying Monte Carlo Simulation



So, When is Excel not Capable of Producing an End User Model?

- 1) When our model is **performance-intensive**
- 2) When our model requires the processing of **large data volumes**
- 3) When our model requires **facilities** not available in Excel such as 3D charting, Animation, etc.
- 4) When our model needs to be interfaced with Data Science and Machine Learning methods
- 5) When our model needs to be embedded in larger programmed applications

C.

What about VBA?

Visual Basic for Applications is a Microsoft programming language that is embedded in all Microsoft 365 applications

Our courses will not require you to know VBA

Yet, if you have a programming background, VBA can expand your simulation capabilities to a large extent . . .

D.

Monte Carlo Simulation Requires
Competence in the following 2 Areas

- 1) Working knowledge of Excel
- 2) Basic statistical practices

What do we need to know in Excel

- 1) What If Tables (Sensitivity Analysis)
- 2) Advanced use of Excel's Charts
- 3) Beginner's knowledge of Macros and VBA
- 4) Location functions: XLOOKUP, XMATCH, INDEX and OFFSET
- 5) The whole set of IFS functions
- 6) The whole set of Error checking functions
- 7) The Name Manager
- 8) Conditional Formatting
- 9) Pivot Tables
- 10) The use of Array Functions



In Lecture 3.2, we shall present
some Good Excel Practices
including some **Do's and Don'ts**

Statistics? . . A Beginner's Knowledge of:

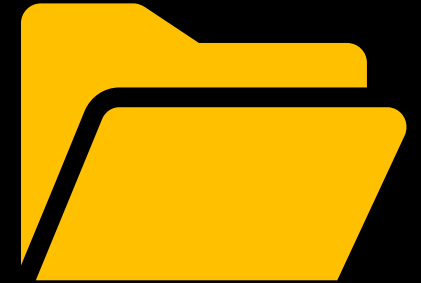
- 1) Standard Deviations, Variance, Standard Errors
- 2) Confidence Intervals using Z-scores
- 3) Descriptive Statistics: skewness, kurtosis, etc.
- 4) Calculating the required number of samples (Scenarios)
- 5) Goodness of Fit Testing (Chi-square Test)
- 6) Simple and Multiple Linear Regression

As they arise, they will be introduced to you



E.

The Resources Folder for each Lecture Contains . . .



- 1) All Excel models (detailed and documented) . . .
- 2) Supporting material: articles, related workbooks and lists
- 3) PDF versions of each lecture's PowerPoint slides
- 4) A document listing all references and credits used in the lecture

F.

Contacting the Instructor

The Instructor can be contacted at any time and for any reason

This can be done via the contacts on the course page on UDEMY's website

Thank you for
viewing this
lecture.

