

Session 1

Introduction to Spreadsheet Models

What Is Modeling?

Running Sums

Running Differences

Named Parameters

References

Old prospector's wisdom

1/2

We're going to country that's very wild and dangerous.

Have to cut our way through jungles and climb mountains so high they rise above the clouds.

Tigers so big and strong they can climb trees with burros in their mouths.

Good!

Glad to hear such tall tales 'cause that means mighty few outsiders have ever set foot there.

— “Howard” the old prospector



Contact info

1 / 3

Rick Brenner
Chaco Canyon Consulting
700 Huron Ave., Suite 11J
Cambridge, MA 02138
(617) 491-6289
rbrenner@ChacoCanyon.com

John-Paul Messina
467 Poplar Street
Roslindale, MA 02131
(617) 956-2802
messinajp@gmail.com

John Fitch
42 Marion Road
Arlington, MA 02474
(617) 852-1386
john_fitch@post.harvard.edu

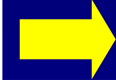
Steve Voight
435 Shawmut Ave #2
Boston, MA 02118
(617) 266-0070
svoight@post.harvard.edu

How can small business units make complex decisions?

1/4

- They have some advantages
 - They needn't get clearance all the way up the chain
 - They can rely more on intuition
 - They're closer to the customer
 - Usually there's less at stake
- And disadvantages
 - They have fewer resources to allocate to sophisticated models
 - Money
 - Compute power (hardware and software)
 - Knowledge and know-how
 - They're often less capable mathematically than central facilities

Solution: Find Faster, Cheaper, Less-Sophisticated Decision Support Technologies

- All readings and homework assignments are available on the Web at
<http://www.rbrenner.com/smm2/>
- In these notes, you will occasionally see things that look like:
 -  Readings: How to Work
 - This is a reference to the Web site readings page called “How to Work,” which you can find from <http://www.rbrenner.com/smm2/readings/>

- Course materials include:
 - Session notes both in PowerPoint and as Web pages
 - Demonstrations in MS Excel
 - Homework solutions in MS Excel
 - Readings and descriptions of demonstrations and solutions on the Web
- You'll need access to
 - MS Word 2000 or later (for your course project)
 - Excel, either:
 - For Windows: MS Excel 2000 or later (for homework, demonstrations and course project)
 - For Mac: Excel 2001 or 2004 (*not* 2008)
 - MS PowerPoint 2000 or later (if you want to read session notes in PowerPoint)
 - A Web browser “compatible” with Firefox version 3+ or Internet Explorer version 7+ (for homework and readings)
 - Virus protection software

- Homework assignment for each session
- Course project, consisting of:
 - A proposal
 - Mid-term status report
 - Final report, business model, and documentation
- Strategy for maximizing your learning
 - Work steadily through the course – don't procrastinate
 - Interact with us and with your classmates
 - Ask questions, offer comments and observations
 - Team up – you usually learn more and do better as part of a team

- Most brain work in companies of the future (and today!) will be done by teams
- The “solo genius” is an archaeological artifact
- You can team up on homework or lab work, provided:
 - You enjoy it
 - You feel it works well for you and your teammates
 - You “pull your weight”
 - You note on the first page or screen who you teamed with
 - They agree to be so noted
- You must write up your results *independently*
 - Write the results in your own words
 - Pretend that you were the team’s recorder
 - Pretend that the team is relying on you to write up the results
- If you submit someone else’s work as your own, we’ll consider it an honor code violation

- 75% Homework
 - Homework is due at 5:35 PM on the due date
 - Late homework assignments are accepted
 - With a 50% penalty within 7 days of due date
 - With a 75% penalty within 14 days of due date – no credit after that
 - We accept redos of homework submitted on time, and graded as 25% or better
 - If you redo your homework and submit it for regrading before the next assignment is due, your new grade is half the sum of the two (rounded down). You can earn up to 50% of the difference between original grade and new grade.
Example:
You submit your assignment on time and earn an 85. You redo your assignment on time, and earn a 100. Your new grade: 92.
 - 5% penalty if homework or project contains macros – resubmission required, lateness penalties might result
 - You can appeal a homework grade within 14 days of due date. After that, no appeals.
- 25% Course Project
- There are lateness penalties for late elements of your course project (see the Web site for details)
- If submitting homework or project by dropbox, you must submit to the correct dropbox to receive credit
- If submitting by email, only the first submission is accepted, so be sure it's right before you click "Send."
- No final exam

Session schedule

1/10

- Classes meet on the dates indicated in blue
- Topics as described in the Syllabus
- Lab session with Teaching Fellow on dates in yellow
- Holidays in gray

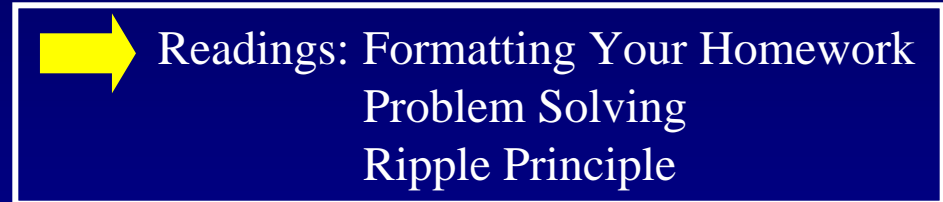
	S	M	T	W	T	F	S
Aug	28	29	30	31	1	2	3
Sep	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
	18	19	20	21	22	23	24
	25	26	27	28	29	30	1
Oct	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
	30	31	1	2	3	4	5
Nov	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	1	2	3
Dec	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
	18	19	20	21	22	23	24
	25	26	27	28	29	30	31
Jan	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31	1	2	3	4
Feb	5	6	7	8	9	10	11

Submitting homework

1/11

- Homework due two hours before each session (5:35 PM Eastern)
- Submit homework through the course dropbox or, in an emergency, by email to ismte130-homework@dce.harvard.edu
- Submit each problem set as a single Excel workbook
 - Name the workbook <lastname><first-initial>NN
 - If your last name has more than one word, suppress all spaces. Examples:
 - MessinaJ15 is problem set 15
 - FitchJ06 is problem set 6
 - For a redo, name the workbook <lastname><first-initial>NN-redo
 - Example: BrennerR06-redo is a redo of problem set 6

- Except where noted, your result must be *computed*, using the Ripple Principle
- First worksheet of each workbook is to be named “Info”. In A1:A5 put:
 - A1 Your name
 - A2 Your email address
 - A3, B3, ... Your team mates
 - A4 The date
 - A5 Version of Excel you used
- Solve each problem on its own worksheet
 - Solve all parts of that problem (a, b, c, ...) on that same worksheet
 - Name the sheet for problem 7.5 Problem7.5 (no spaces)
 - Only one problem per worksheet



Readings: Formatting Your Homework
Problem Solving
Ripple Principle

- It's important to keep up with the pace of this course
- Don't delay working the homework until the day before it's due
- A recommended regular routine:
 - After the session:
 - Read the solutions to previous homework; redo if desired
 - Read the homework assignment (30 minutes max)
 - Later:
 - Spend one hour on the homework
 - Send email questions
 - After that:
 - Complete the homework
 - Print next session's notes and homework assignment to bring to class

 Readings: How to Work

About the homework problems

1/14

- Some problems require thought
 - Some are similar to—but go beyond—what we show you in class
 - This is meant to prepare you for what you will encounter at work
- Many problems are “word problems”
 - You’ll have to read and understand what they tell you and what they ask for
 - You’ll have to convert that understanding into spreadsheets
- You might feel that the wording of some problems is ambiguous
 - This too is meant to prepare you for what you will encounter at work
 - Resolving the meaning is part of what we’re trying to teach
 - If you’re unsure of what is wanted:
 - Consult your teammates or others in the class
 - Send mail to the course discussion list
 - In some cases, it’s possible that we might not provide a satisfactory resolution in advance

- For your project, you'll develop a model of
 - a business
 - a part of a business
 - a business process
- You can choose to model anything you like, in consultation with us
- Submit a written proposal/project plan for approval
- Implement and document the model
 - User guide
 - Maintenance manual
- Demonstrate its use to study two scenarios
- Write an interim and a final report



- We're all of us learning here
 - You learn from the material we present
 - We learn from you
- To help us learn from you:
 - At the end of each session, please fill out a “Keep/Change/Add” form at the course Web site
 - Include:
 - One thing you want us to *keep* doing
 - One thing you want us to *change*
 - One thing you wish we had done and want us to *add*
 - You can be anonymous – your choice
 - During the week, we'll send you by email the “Keep/Change/Add” ideas (minus your names) from the previous session so you can see what others wrote

- No textbook
 - There really is no suitable text that I've found
 - We provide references where possible
 - Session notes, supplementary readings, problem set solutions
- Session format
 - Discussion of solutions to homework
 - Discussion of new material for the next session
 - Examples
 - Explanation of the next problem set assignment
- All session notes, demonstrations, homework assignments and homework solutions are on line
 - Tips, tools and techniques are on the web
 - Excel add-ins

 Readings: Special Tools

- We recommend this structure:
 - session01
 - session02
 - session03
 - session04
 - session04.xls
 - solve04.xls
 - <your-last-name><your-first-initial>04.xls
 - session05
 - ...
 - session12

[Download the Hierarchy](#)

These slides

Slide Title

Session Number

Slide Number

1/19

Course Title

Example

Sheet tab name in
examples workbook

◆ ConvolutionGraphically

The practice of business is changing

1/20

- Information technology is changing how we do business
- Information is decentralized and easily copied and dispersed
 - Shared databases (computer networks, client/server)
 - Email, photocopying, fax, Internet, intranet
 - Overnight delivery (aircraft-based messenger networks)
- Managements no longer “own” the big picture view
- Organizations are decentralizing decision-making process
 - They can respond more quickly to dynamic markets
 - Their competitors are doing it – or they’re afraid they will
- Smaller units are making complex decisions

Need: Smaller business units must upgrade their modeling skills to support more complex decisions

Two key messages

1/21

- Small, agile business units with small staffs need “quick and dirty” desktop modeling
- Simple models can be helpful
- Simple models are easy to make
- You can make simple models

Use simple models for time-constrained
and resource-constrained situations

Simple models have their limits

- This isn't a course in using Microsoft Excel
 - You don't need to be an Excel expert and you won't become one if you aren't
 - Being an expert in Excel isn't much of an edge
- You'll have to understand how to use Excel in a basic way – you won't have to write complex macros
- What you'll need to know (beyond the basics) is readily available in Excel on-line help
- Useful references:
 - Microsoft Excel documentation and on line help
 - Information on the course Web site
- Optional references:
 - Eric Wells, *Developing Excel Solutions*, Microsoft Press.
 - Jeff Webb, *Using Visual Basic for Applications (Excel Edition)*, Que Books.

- Demonstrate a wide variety of techniques for using spreadsheets to make models of business processes
- Let you practice these techniques in a series of problems that are each designed to illustrate use of a specific technique
- Let you create a model of a complex business process, in which you have to decide which techniques to use (course project)
- Let you practice working in teams on spreadsheet projects

Let's Begin!

- Modeling is the art of simulating the behavior of a system or process
- Faithful models exhibit behavior analogous to the system they model
- Models usually have validity with respect to a particular behavioral domain
- Their value is determined by
 - Model-based costs
 - Development
 - Maintenance
 - Training
 - Use
 - Cost of examining the system directly
 - Fidelity

- A “running sum” is a cell-by-cell cumulative sum of a range of cells
- Sometimes called
 - Accumulation
 - Integration (a term from calculus)
- Examples of when you need it:
 - Computing total head count given a hiring/termination stream
 - Cumulative total revenue from quarterly revenue
 - Total principal paid given a loan repayment schedule
- To compute the running sum you need:
 - The initial value
 - The data stream



- The inverse of running sum – sometimes called “derivative” or “running difference”
- Examples of when you need the running difference
 - Compute a hiring or termination stream from a total headcount target
 - Quarterly revenue from cumulative revenue
- To compute the running difference you need:
 - The initial value
 - The data stream




- Naming parameters helps you in several ways. Naming makes models:
 - More useful – easier to change
 - Cheaper to build and modify
 - More reliable – more internal consistency
 - More maintainable, more readable
 - Easier for others to understand
 - More error-free
- Common error in spreadsheet modeling: “parameter sprinkling”
 - Hard-wired numbers aren’t distinguishable
 - You have to chase all over if you want to change the value
- One form of parameterization: cell reference
- Collect all the parameter cells for a given sheet into one block – the parameter block
- You can even name the parameter block

◆ RunningSumsAndDifferences

◆ ParameterBlock

Choosing names for parameters

1/28

- Make names short but understandable
- Legal characters: A-Z, a-z, 0-9, underscore, period
- First character must be a letter or underscore
- Avoid names that could be explicit cell references: A3, IV256
 - Prior to Excel 2007, lower right corner cell is IV65536
 - In Excel 2007 (and presumably henceforward), lower right corner cell is XFD1048576
- Use mixed case
- Develop a set of naming conventions and use them consistently
 - “Hdct” – headcount, “Qtr” – quarter, “Rev” – revenue, “Exp” – expense, etc
 - Example: HdctExpPQtr – Headcount Expense per Quarter
-  Readings: Names

- The “scope” of a name definition is the realm in which it’s valid
- Two scopes in Excel:
 - Global (“book level”)
 - Local (“sheet level”)
- When you define a name, you choose its scope
 - Excel 2000-04-11 Local: prefix the name with <name of sheet>!
 - Excel 2000-04-11 Global: no prefix
 - Excel 2007-10: you can use the Name Manager to set scope
- You can access any name from any sheet. Examples:
 - Sheet1!Expenses gets the local name defined in scope of Sheet1
 - BookName!Expenses gets the global name, even if within scope of a similar local name
 - Expenses gets the “closest” definition (local>global)



Relative and absolute references

1 / 30

- | | | |
|----------|---------------------|----------|
| • \$B\$3 | Completely Absolute | R3C2 |
| • B3 | Completely Relative | R[1]C[1] |
| • B\$3 | Column-Relative | R3C[1] |
| • \$B3 | Row-Relative | R[1]C1 |

Relative
to A2


- You can't really tell the behaviors apart until you either
 - Copy
 - Paste
 - Fill Down/Fill Up
 - Fill Right/Fill Left

 Readings: References

 ReferenceExamples

This Is a Basic Spreadsheet Concept
That's Worth Mastering

- When you define a name, it can refer to
 - A constant (string or number)
 - A reference to a cell or range
The reference can be any kind – absolute, relative, mixed
 - A formula
 - You can define a name for any formula you can enter into a worksheet
 - Example: =SUM(A1:A3)
- Some names are especially handy.
If the active cell is B2:
 - Define Above as B1, Below as B3, Left as A2, Right as C2 (all relative)
 - Then using these names makes formulas far more readable (left/right/above/below)
 - Make an Excel template with your header info and these names built in
- By default, Excel's Define Name dialog and New Name dialog insert absolute references. Rotate through the four modes with F4 (Windows) or Command+T (Mac).

-  Course readings:
 - Getting Started
 - Worksheet Functions
 - Workbooks
 - Names
 - Navigation
 - References
- M. Hammer and J. Champy. *Reengineering the Corporation*. Harper Business, 1993.
- T. Peters. *Liberation Management*. Fawcett, 1992.
- J.R. Katzenbach and D.K. Smith. *The Wisdom of Teams*. Harvard Business School Press, Boston, 1993.

Preview of Next Time: Analysis and Synthesis

1/33

- Analysis and Synthesis
 - Decomposing and Recombining
 - Arrays often result – array manipulation required
- Techniques of array manipulation
 - Array arithmetic (+, -, *, /, ^, ...)
 - Matrix arithmetic (MMULT, TRANSPOSE)
 - Use Matrix arithmetic when you want to perform a synthesis
 - Use Array arithmetic between analysis and synthesis