

Treeplan Mechanics and Sensitivity Analysis in Decision Analysis

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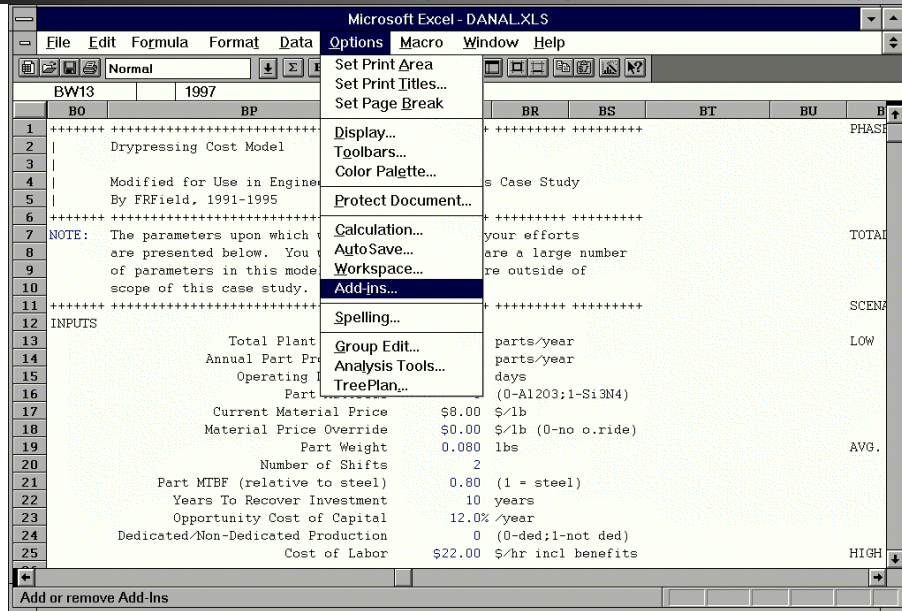
Treeplan Mechanics

- Excel Add-In
 - A Set of Program Commands
 - Packaged Into A Single Module
 - Providing A Set Of Tools
 - For Decision Tree Calculations
 - Within A Spreadsheet
- Available From The DSP WWW Pages
- Shareware Application
- Exploits Spreadsheet Strengths While Providing Basic Decision Support Calculations
- Avoids the Overhead of the Expected Value Calculations and Tree Pruning
- BUT -- Still Relies Upon The User -- GIGO Still A Danger

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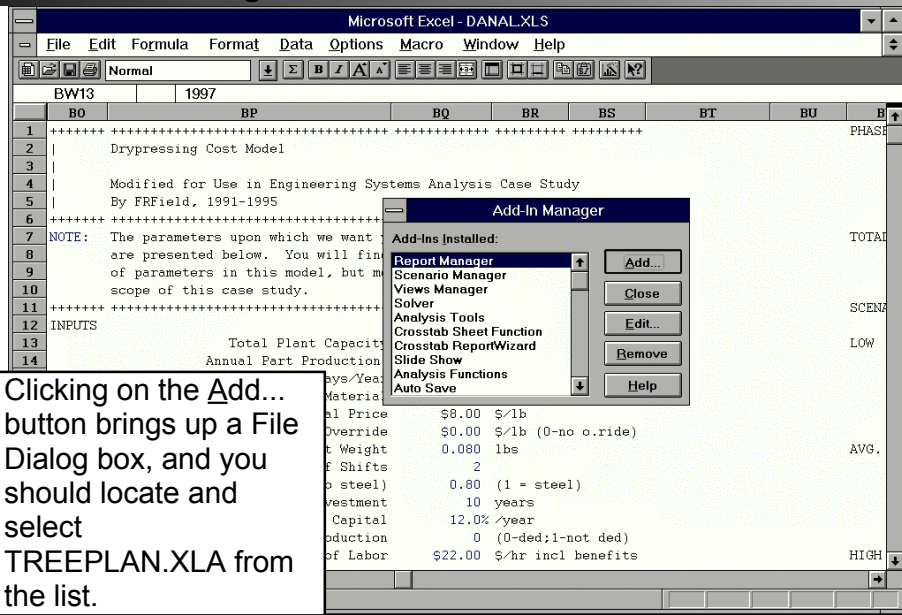
Getting To TreePlan - Start By Loading The Add-In Manager



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The Add-In Manager



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The Add-In Manager With TREEPLAN.XLA Listed

If you do it right, TREEPLAN.XLA should appear in the Add-In Manager list following your click of the OK button.

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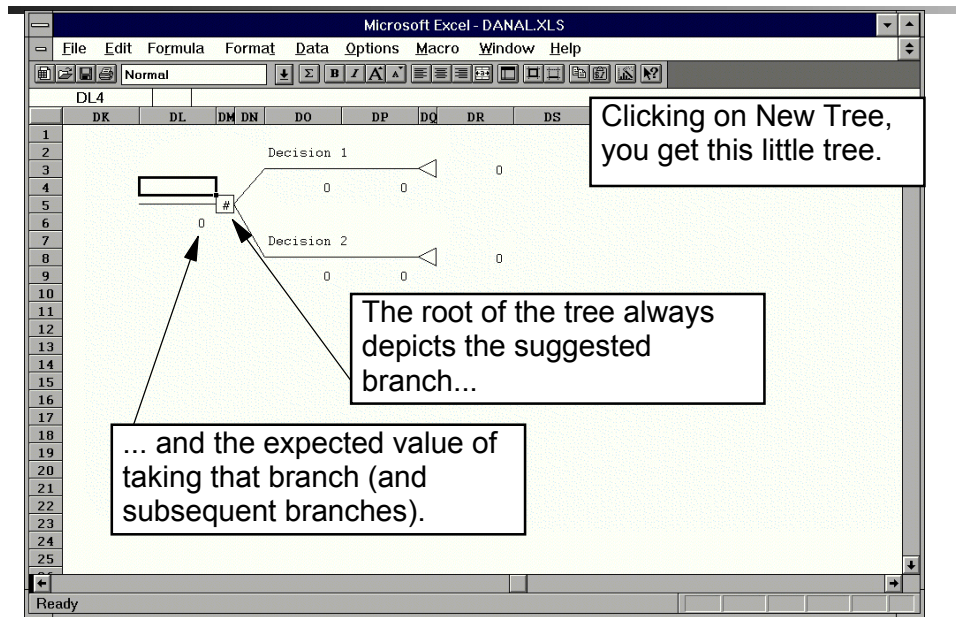
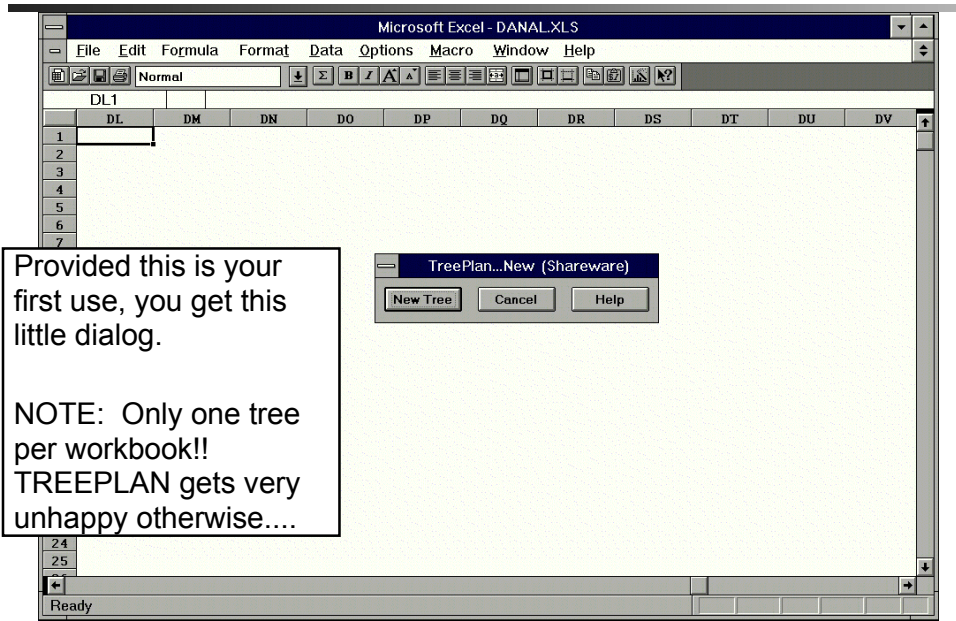
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Using Treeplan - Invoking the Add-In

Treeplan now appears in your Options menu. You can also invoke it with Ctrl-A, provided you have not already assigned that keystroke combination to another macro.

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Changing a Tree Node

The screenshot shows Microsoft Excel with a decision tree diagram. The tree starts with a square decision node labeled '1' containing the number '1'. It branches into two paths: 'Decision 1' leading to a square node with '0' and '0', and 'Decision 2' leading to a triangle node with '0' and '0'. A text box in the lower right of the spreadsheet area contains the following text:

Of course, trees are not just decisions; chances are necessary, too. Treeplan lets us change tree elements by

- 1) selecting a node and
- 2) invoking Treeplan

Invoking Treeplan with a Node Selected

The screenshot shows Microsoft Excel with the same decision tree diagram as in the previous slide. The 'Options' menu is open, and the 'TreePlan...' option is highlighted. The menu items visible are:

- Set Print Area
- Set Print Titles...
- Set Page Break
- Display...
- Toolbars...
- Color Palette...
- Protect Document...
- Calculation...
- Auto Save...
- Workspace...
- Add-ins...
- Spelling...
- Group Edit...
- Analysis Tools...
- TreePlan...**

The status bar at the bottom of the window reads: "Build or modify a decision tree".

Invoking Treeplan with a Node Selected

The screenshot shows Microsoft Excel with a decision tree diagram. The tree starts with a square decision node labeled '1' containing the number '1'. It branches into two options: 'Decision 1' (square node) and 'Decision 2' (triangle node). Each branch has a probability of '0' and a terminal node with a value of '0'. The 'TreePlan...Terminal (Shareware)' dialog box is open, showing options to change node types, paste subtrees, or remove branches. The 'Branches' section is set to 'Two'.

Note the many options for changing the tree....

One key many miss is the "Paste Subtree" - this can save a lot of time!

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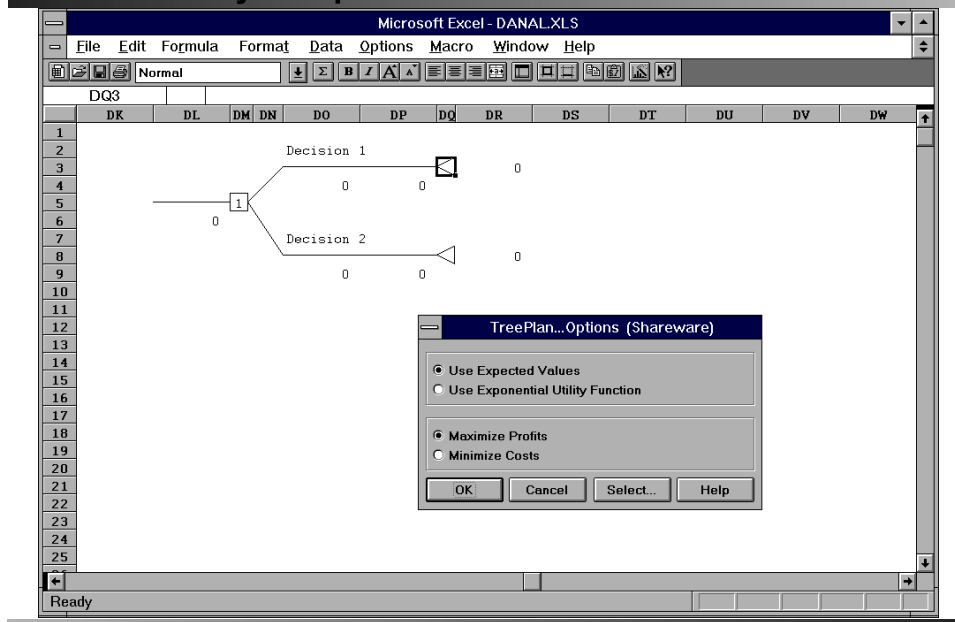
Adding a Chance Node To The Tree

This screenshot is identical to the previous one, showing the same decision tree and the 'TreePlan...Terminal (Shareware)' dialog box. The dialog box options are the same as in the previous slide.

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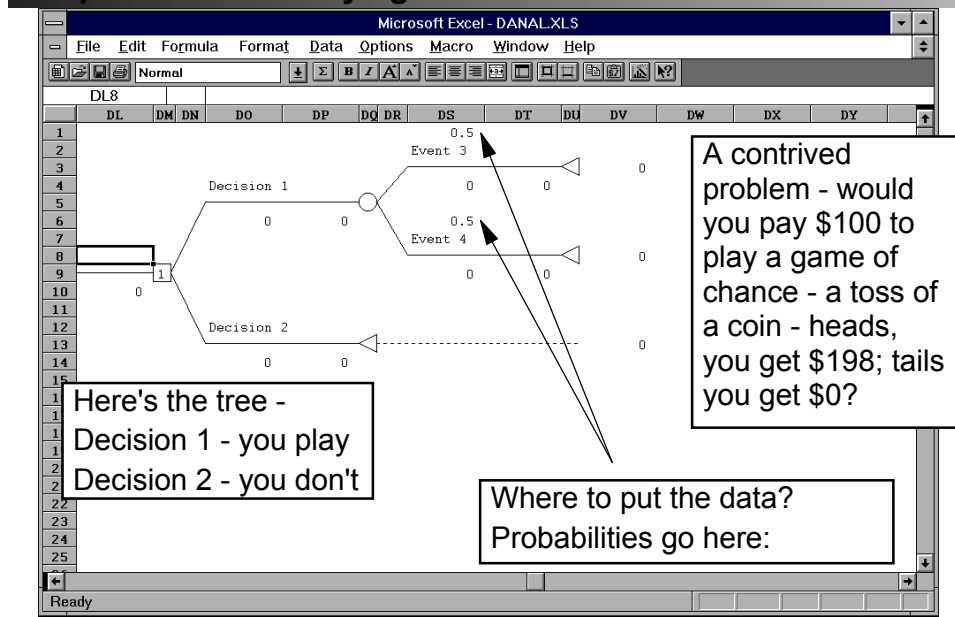
Tree Plan Analysis Options



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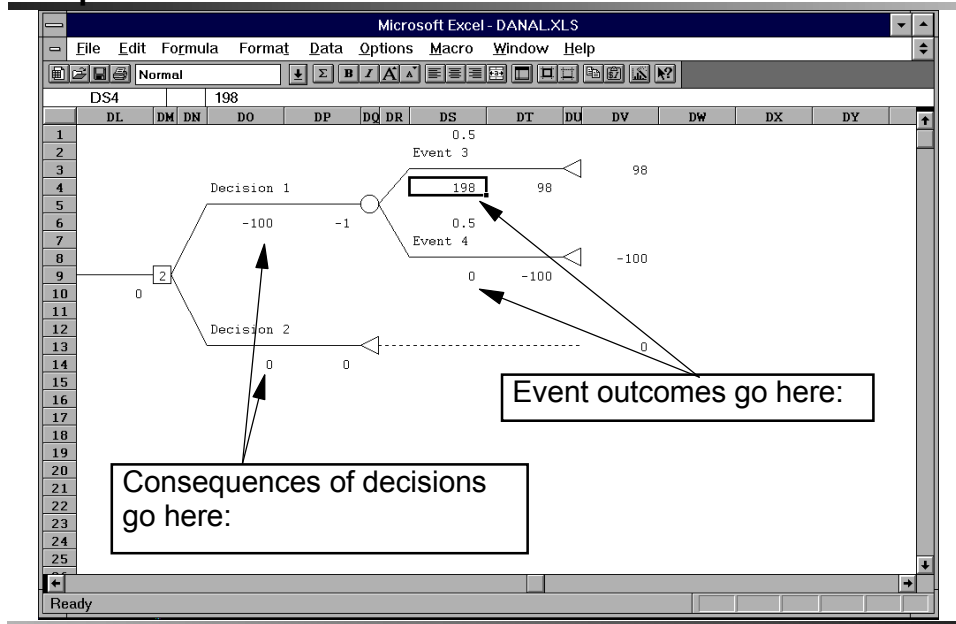
Sample Problem - Playing A Game Of Chance



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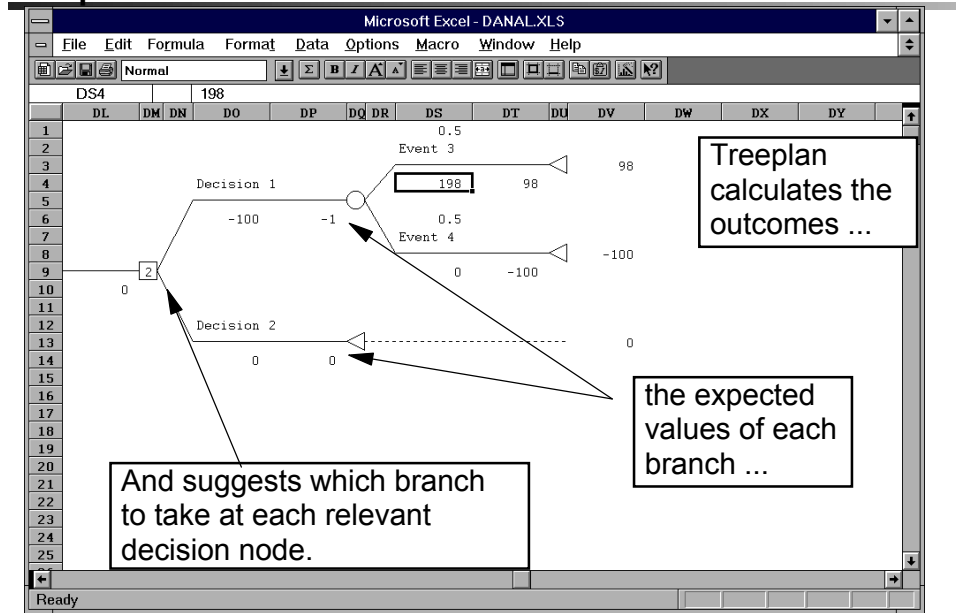
Sample Problem



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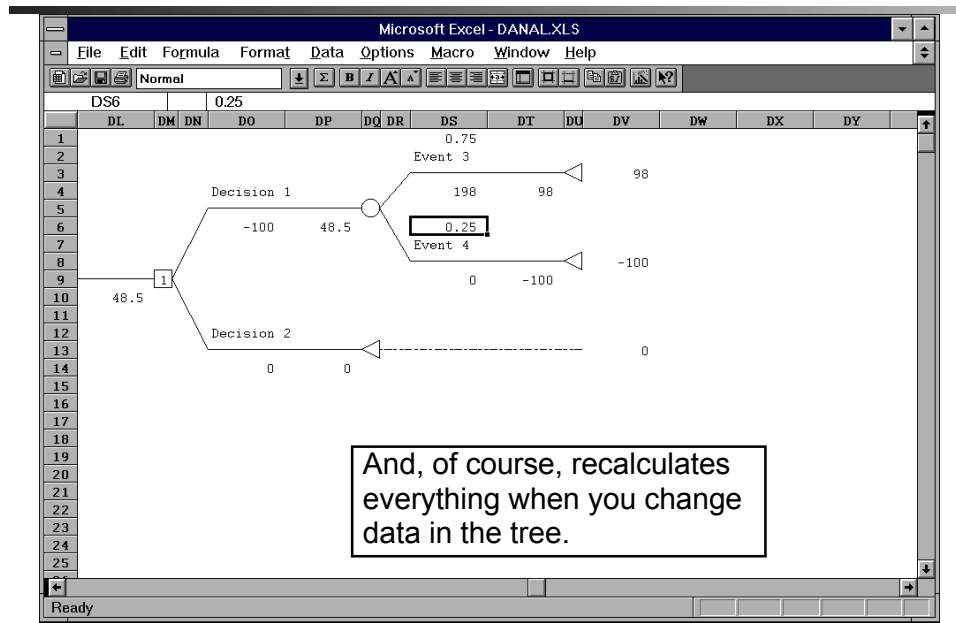
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Sample Problem



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Key Benefit

Exploration of Consequences of Information Failure

- Decision Trees Divide A Bewildering Array Of Uncertainties Into A Set Of Simple Questions:

Given *This*, *This* and *This*, What Action Should I Take?

- A Reduction of Complexity to a Set of Simple Questions
- Gives Rise to a Powerful Ability:

How wrong do my assumptions have to be before the actions I believe are correct become stupid choices?

- Sensitivity Analysis A Key Dimension For Treating This Problem

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Consider This Problem From The Book (Paddy O'Toole)

# employees	1	2	3
Total Salary	\$14k	\$28k	\$42k
Production	1200	1800	2400
Retail Price	\$30		
Discount Price	\$15		

	Low	Med-Low	Med-High	High
Retail Demand	1000	1500	2000	2500
Probability (%)	20%	30%	40%	10%

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Calculations (details left to the reader)

- Appropriate strategy is to hire two employees and produce at Medium Levels
- BUT, What if the Demand Forecast is Wrong?
 - In Particular, What if the Probabilities Are Not as Stated?
- Raises a Different Sort of Question:
How *Wrong* Must The Probabilities Be Before Hiring Two Employees Becomes An Irrational Choice?

High Output \$19.35k	High	\$30k
	MedHigh	\$24k
	MedLow	\$16.5k
	Low	\$9k
Medium Output \$22.25k	High	\$26k
	MedHigh	\$26k
	MedLow	\$21.5k
	Low	\$14k
Low Output \$21.40k	High	\$22k
	MedHigh	\$22k
	MedLow	\$22k
	Low	\$19k

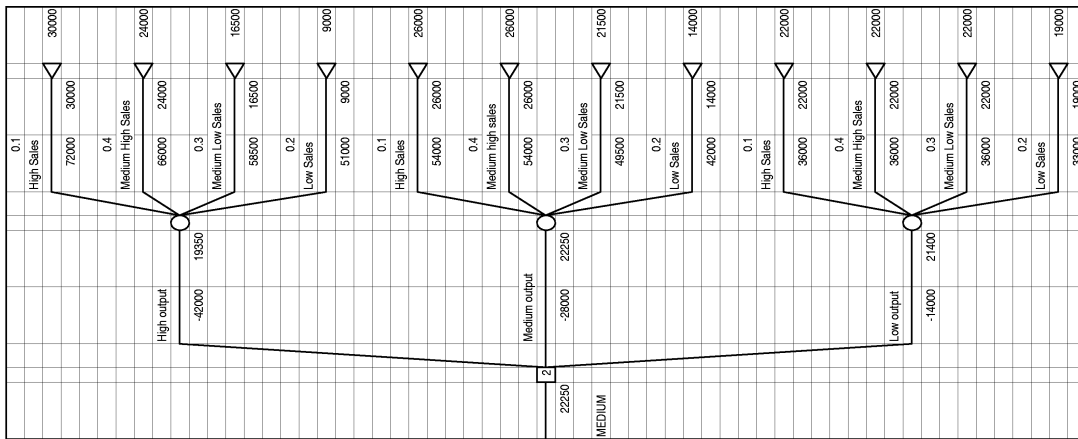
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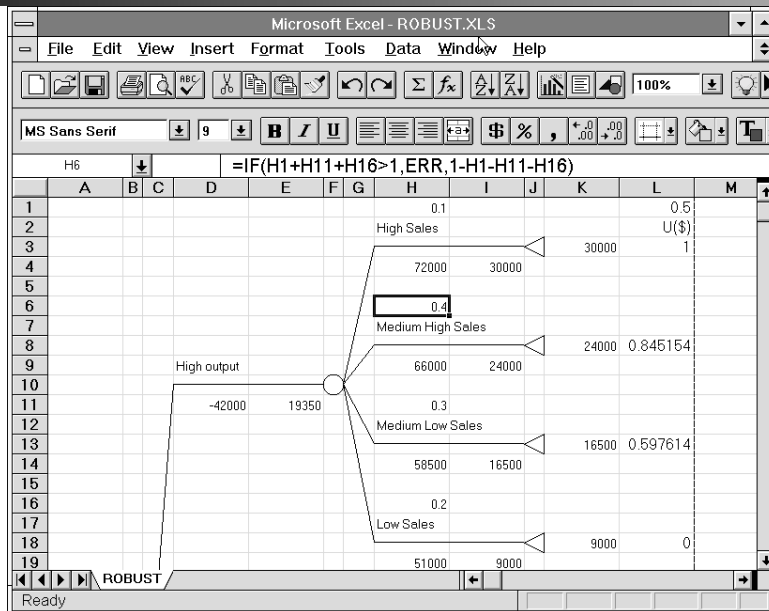
Analytical Approach

- Construct The Treeplan Tree For The Problem
- Make Assumptions:
 - Pr(Low) Can Safely Be Fixed At 20%
 - All Other Probabilities Can Vary
 - Choice Of Output Does Not Effect Probabilities
- Structure The Decision Tree So That
 - Probabilities On Each Decision Branch Are Coupled
 - Probabilities Within Each Decision Branch Are Constrained To Sum To 1.0
- Then, Do A Spreadsheet Sensitivity Analysis

The Treeplan Table



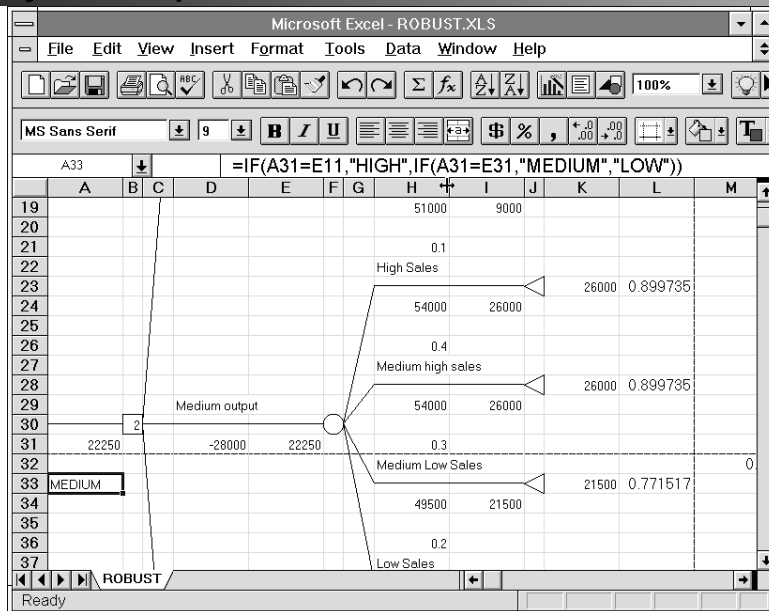
Structure The Tree



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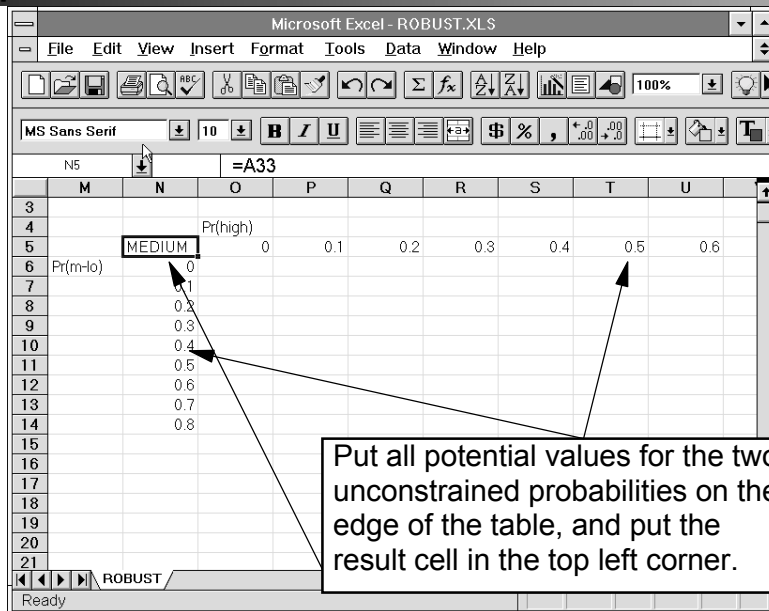
Simplify The Output From The Tree



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Set Up The Data Table



Microsoft Excel - ROBUST.XLS

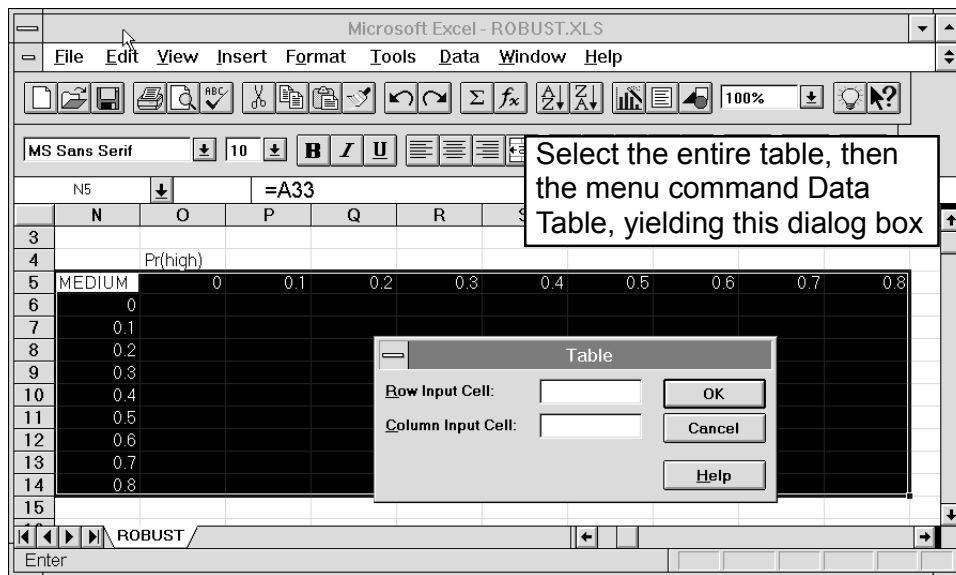
File Edit View Insert Format Tools Data Window Help

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	M	N	O	P	Q	R	S	T	U
3									
4			Pr(high)						
5		MEDIUM	0	0.1	0.2	0.3	0.4	0.5	0.6
6	Pr(m-lo)		0						
7			0.1						
8			0.2						
9			0.3						
10			0.4						
11			0.5						
12			0.6						
13			0.7						
14			0.8						

Put all potential values for the two unconstrained probabilities on the edge of the table, and put the result cell in the top left corner.

Invoke the Data Table Command



Microsoft Excel - ROBUST.XLS

File Edit View Insert Format Tools Data Window Help

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Select the entire table, then the menu command Data Table, yielding this dialog box

	N	O	P	Q	R	S
3						
4			Pr(high)			
5	MEDIUM	0	0.1	0.2	0.3	0.4
6		0				
7		0.1				
8		0.2				
9		0.3				
10		0.4				
11		0.5				
12		0.6				
13		0.7				
14		0.8				

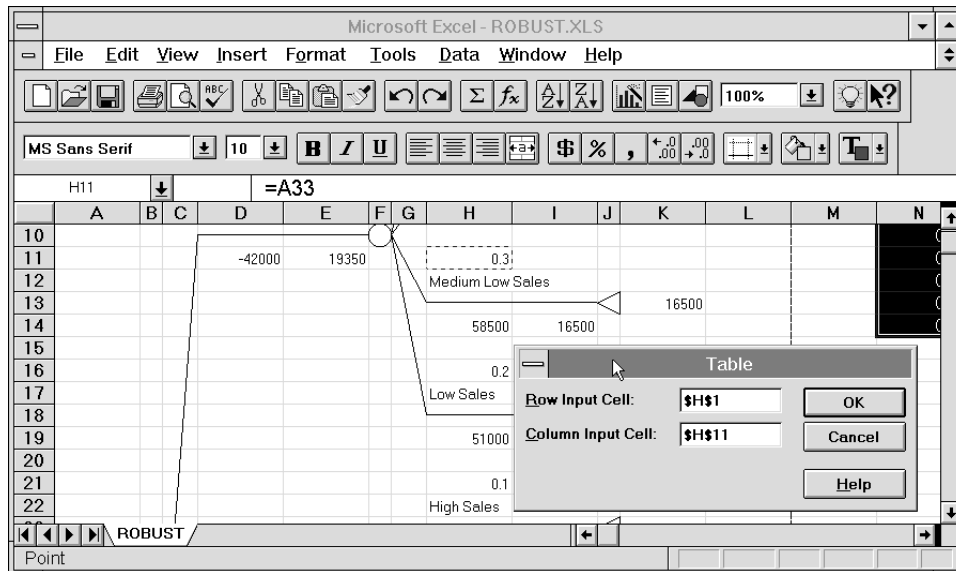
Table

Row Input Cell:

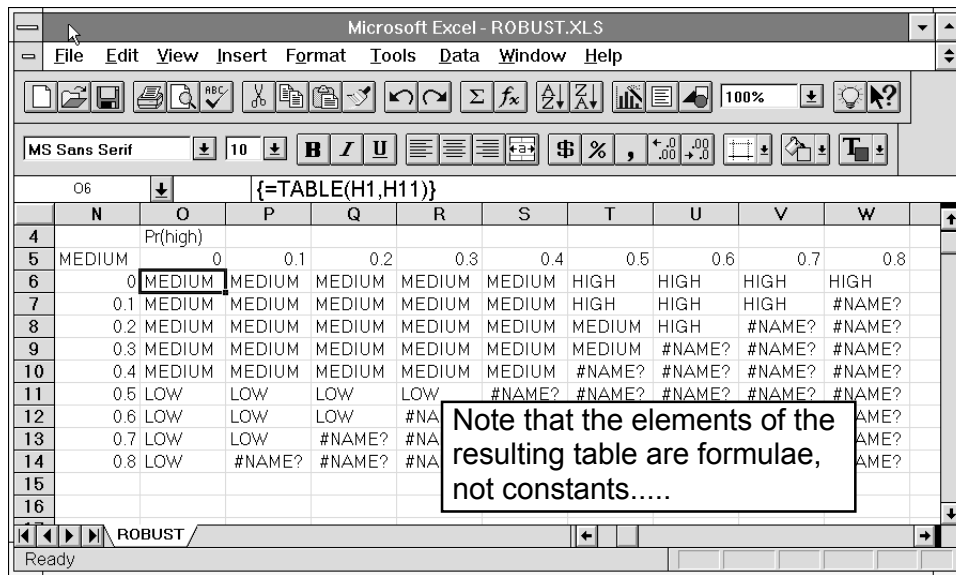
Column Input Cell:

OK Cancel Help

Put The Input Cells Into The Dialog Box



With The Following Result



Now, What Does It Mean?

Base case: $\text{Pr}(\text{high}) = 0.10$
 $\text{Pr}(\text{m-lo}) = 0.30$

		Pr(high)									
	MEDIUM	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	
Pr(m-lo)	0	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH	HIGH	HIGH	
	0.1	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	HIGH	HIGH	HIGH	#NAME?	
	0.2	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	HIGH	#NAME?	#NAME?	
	0.3	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	#NAME?	#NAME?	#NAME?	
	0.4	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM	#NAME?	#NAME?	#NAME?	#NAME?	
	0.5	LOW	LOW	LOW	LOW	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	
	0.6	LOW	LOW	LOW	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	
	0.7	LOW	LOW	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	
	0.8	LOW	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?	

How wrong must the estimated probabilities be before MEDIUM is "wrong?"