Decision Analysis

Topics to be covered:

- 1. Decisions versus outcomes
- 2. Review of Contingency Table and Basic Probabilities read the DAReview.doc
- 3. Payoff Tables and Features of Decision Problems
- 4. Decision Rules
 - a. Nonprobabilistic rules
 - i. MaxiMax
 - ii. MaxiMin
 - iii. MiniMax Regret
 - b. Probabilistic rules
 - i. Maximize Expected Monetary Value (EMV)
 - ii. Minimize Expected Regret or Expected Opportunity Loss (EOL)
- 5. Expected Value for Perfect Information (EVPI)
- 6. Decision Trees and Use of Excel@ in Decision Analysis
- 7. Sensitivity Analysis and Graphic Sensitivity Analysis
- 8. Expected Value for Sample Information (EVSI)
- 9. Summary of Decision Analysis

Good Decisions versus Good Outcomes

	Good Outcome	Bad Outcome	
Good Decision	65	5	70
Bad Decision	5	25	30
	70	30	100

P(Good Outcome | Good Decision)=65/70=92.86% P(Bad outcome | Good Decision)=5/70=7.14%

P(Good Outcome | Bad Decision)=5/30=16.67% P(Bad Outcome | Bad Decisioin)=25/30=83.33%

Review of Contingency Table and Basic Probabilities – read the DAReview.doc

Pav	off '	Tables	and	Featur	es of	Decision	Problems
-----	-------	--------	-----	--------	-------	----------	----------

		Α		В		С		
1								
2	Magn	olia	a Inns	Parcel of La	and Near L	ocation		
3				Α		В		
4	Current purcha	ase	price	\$18	9	512		
5	Present value flows if hotel a built at this loo	of f and cati	uture cash airport are on	\$31	9			
6	Present value price of parce not built at this	off lift slo	uture sales the airport is cation	\$ 6				
7								
8	(Note	e: All values a	re in millions of	dollars.)		_	
9								
10	Computations	tog	et the Pavoff I	Matrix				
11	Land F	ouro	hased	Airport is	Built at Lo	cation		
12	at Lo	cati	ion(s)	Å		В		
13		Α		= 31 - 18 = 13	= 6 - 18 =	(12)		
14		В		= 4 - 12 =(8)				
15	1	A& E	}	=31 - 18 + 4 - 12	=23 - 12 -	+ 6 - 18 =	(1)	
16	N	lone	Ð	0				
17								
18				Payoff Matrix				
19	Land F	Purc	hased	Airport is	Built at Lo	cation		
20	at Lo	cati	ion(s)	Α		В		
21		Α		\$13	(\$12)		
22		В		(\$8)	9	611		
23	1	A&E	}	\$5		(\$1)		
24	N	lone	Ð	\$0		\$0		
		Fea	atures of Decisi	on Problems:	E	vents or of Wo	States rld	
	I		۵	B	c/	D	F	Decision Criteria
		18	-	Payoff Matrix	/	5	- /	of Rules
		19	Land Purchased	Airport is Built	at Location			
^	Itomotivo	20	at Location(s)	Α	В	Max	Min	
A C		21	A	\$13	(\$12)	\$13	(\$12)	Movimin
0	Action	22	B	(56) \$11 \$11 \$5 (\$1) \$5				WAXIIIIII
		23	None	\$0 \$0	\$0	\$0	\$0	

2

Payoff Values

Maximax

	А	В	С	D	E	F
1	Pay	off Matrix				
2	Land Purchased	Airport is Bu	ilt at Location			
3	at Location(s)	А	В			
4	A	\$13	(\$12)			
5	В	(\$8)	\$11			
6	A&B	\$5	(\$1)			
7	None	\$0	\$0			
8						
9	Regret or	Opportunity Loss				
10	Land Purchased	Airport is Bu	ilt at Location			
11	at Location(s)	Α	В			
12	А					
13	В					
14	A&B					
15	None					
16	Probability(pj)					
17						
18						
19	Pay	off Matrix				
20	Land Purchased	Airport is Bu	ilt at Location			
21	at Location(s)	А	В			
22	A	\$13	(\$12)			
23	В	(\$8)	\$11			
24	A&B	\$5	(\$1)			
25	None	\$0	\$0			
26	Probability(pj)					
27						
	Expected Value with Perfect					
28	Information (EVwPI)					
29						
30	Maximum of EMV					
31						
	Expected Value of Perfect					
32	Information (EVPI)					
33						
34	Sensitivity Analysis					
35						
36	Decision Tree					
37						
38	Use Decision Tree for EVwPI					

(Decision.xlsx/ImnsBlank)

None Probabilistic Decision Rules

	A	В	D	E	
1	Magnolia Inns	Payoff Matrix	MiniMax Regret or Opportu	unity Loss	
2	Land Purchased	Airport is Bu	ilt at Location		
3	at Location(s)	А	В		
4	А	\$13	(\$12)		
5	В	(\$8)	\$11		
6	A&B	\$5	(\$1)		
7	None	\$0	\$0		
8					
9	Regret or Opportunity Loss = Ma	ax(Possible Profit for an Ev	vent) - Actual Profit for an A	ction taken	
10					
11	Land Purchased	Airport is Bu	ilt at Location		
12	at Location(s)	Α	В		
13	Α	= 13 - 13 = 0	= 11 - (-12) = 23		
14	В	= 13 - (-8) = 21	= 11 - 11 = 0		
15		= 13 - 5 = 8	= 11 - (-1) = 12		
16	None	= 13 - 0 = 13	= 11 - 0 = 11		
17					
18	Regret or Opportunity Loss	=MAX(\$B\$4:\$B\$7)-B4	=MAX(\$C\$4:\$C\$7)-C4		
19	Land Purchased	Airport is Bu	ilt at Location	MiniMax Regret	or Opportunity Loss
20	at Location(s)	Α	В	Max	
21	Α	\$0	\$23	\$23	=MAX(B21:C21)
22	В	\$21	\$21		
23	A&B	\$8	\$12	←Minimum	
24	None	\$13	\$13		

(Decision.xls/Imns1Reg)

Probabilistic Methods

	, , , , , , , , , , , , , , , , , , , ,					
	А	В	С	D	E	
1	Maximize Expected Mon	etary Value = Sum of	Payoffs times its F	Probabilities		
2		Payoff Matrix				
3	Land Purchased	Airport is Buil	t at Location	=SUMPRODUCT(\$B\$10:\$C\$10,B5:C	:5)
4	at Location(s)	Α	EMV			
5	Α	13	-12	-2		
6	В	-8	11	3.4	←Maximum	
7	A&B	5	-1	1.4		
8	None	0	0	0		
9						
10	Probability (p _j)	0.4				
	-					-

Expected Monetary Value (EMVi) = $\sum_{i} r_{ii} p_{i}$

А	В	С	D	E	F	G	Н	
Minimize Expected Regre	et or Expected Oppor	tunity Loss (EOL)						
Regret or Opportunity Lo	SS							
Land Purchased	Airport is Buil	t at Location	=SUMPRODUCT(\$B\$90:\$C\$90,B85:	C85)			
at Location(s)	Α	В	EOL					
Α	\$0	\$23	\$13.80					
В	\$21	\$0	\$8.40	←Minimum				
A&B	\$8	\$12	\$10.40					
None	\$13	\$11	\$11.80					
Probability (p _j)	0.4	0.6						
EMV and EOL always resu	It in the same decisi	on alternative						
Expected Value of Perfec	t Information (EVPI)	= Expected Profit u	inder certainty - e	expected moneta	ry value of	the best a	lternative	
EVPI is also called Expected	ed Opportunity Loss	(EOL) from the be	st decision					
			Expected Value	EMV of Best				
			under Certainty	Action or				
			or with Perfect	Maximum of				
			Information	EMV	EVPI			
Computation for EVPI	5.2	6.6	11.8	3.4	8.4			
EVPI = EV w PI - Max EMV	= Minimum of EOL							
	A Minimize Expected Regre Regret or Opportunity Lo Land Purchased at Location(s) A B A&B None Probability (p _j) EMV and EOL always resu Expected Value of Perfect EVPI is also called Expected Computation for EVPI EVPI = EV w PI - Max EMV	A B Minimize Expected Regret or Expected Oppor Regret or Opportunity Loss Land Purchased Airport is Builiat Location(s) A \$0 B \$21 A&B \$8 None \$13 Probability (pj) 0.4 EMV and EOL always result in the same decision Expected Value of Perfect Information (EVPI) EVPI is also called Expected Opportunity Loss Computation for EVPI 5.2 EVPI = EV w PI - Max EMV = Minimum of EOL	A B C Minimize Expected Regret or Expected Opportunity Loss Regret or Opportunity Loss Land Purchased Airport is Built at Location at Location(s) A B \$23 B \$21 A \$0 A&B \$8 S13 \$11 Probability (p _j) 0.4 O 6 EMV and EOL always result in the same decision alternative Expected Value of Perfect Information (EVPI) = Expected Profit UEVPI is also called Expected Opportunity Loss (EOL) from the best Computation for EVPI 5.2 6.6 EVPI = EV w PI - Max EMV = Minimum of EOL EVI	A B C D Minimize Expected Regret or Expected Opportunity Loss (EOL) Regret or Opportunity Loss State of Comportantity Loss (EOL) Regret or Opportunity Loss A B EOL Land Purchased Airport is Built at Location =SUMPRODUCT() at Location(s) A B EOL A \$0 \$23 \$13.80 B \$21 \$0 \$8.40 A&B \$8 \$12 \$10.40 None \$13 \$11 \$11.80 Probability (p _j) 0.4 0.6	A B C D E Minimize Expected Regret or Expected Opportunity Loss Regret or Opportunity Loss State of the second se	A B C D E F Minimize Expected Regret or Expected Opportunity Loss (EOL) Regret or Opportunity Loss Image: Control of the second of the seco	A B C D E F G Minimize Expected Regret or Expected Opportunity Loss <td< td=""><td>A B C D E F G H Minimize Expected Regret or Expected Opportunity Loss (EOL) Image: Comportunity Loss Image: Comport is Built at Location =SUMPRODUCT(\$B\$90:\$C\$90,B85:C85) Image: Comport is Built at Location <t< td=""></t<></td></td<>	A B C D E F G H Minimize Expected Regret or Expected Opportunity Loss (EOL) Image: Comportunity Loss Image: Comport is Built at Location =SUMPRODUCT(\$B\$90:\$C\$90,B85:C85) Image: Comport is Built at Location Image: Comport is Built at Location <t< td=""></t<>

(Decision.xls/Imns2EVPI)

	А	В	С	D	E	F	G	Н	- I	J	K	L	М	N
1	Sensitivity Analysis													
2							1	set up Pa	off Matrix	and Sensit	tivity Anal	ysis Table a	as Given he	re
3		Payoff Matrix	(2	select cel	ls A14 thro	ugh E25				
4	Land Purchased	Airport is Bu	ilt at Locatio	SUMPRODU	JCT(\$B\$79:\$C\$	79,B74:C74)	3	Click Data	, Data Tool	s, What-if	Analysis, D	ata Table		
5	at Location(s)	Α	В	EMV			4	Specify B	L1 (prob. To	o build at A	A) as Colum	nn Input Ce	ell	
6	А	13	-12	-2			5	Click OK						
7	В	-8	11	3.4	←Maximum		6	Highlight	A15:E25 to	draw Insei	rt/Scatter o	hart		
8	A&B	5	-1	1.4			7	Excel@Se	elect Data/I	Edit to mat	tch the nan	ne with th	e plot	
9	None	0	0	0										
10														
11	Probability (p _j)	0.4	0.6											
12							15 -							
13														
13		EMV A	EMV B	EMV A&B	EMV None									
14	Probability to build at A	EMV A -2	EMV B 3.4	EMV A&B 1.4	EMV None 0		10							
14 15	Probability to build at A 0.0	EMV A -2 -12	EMV B 3.4 11	EMV A&B 1.4 -1	EMV None 0 0		10							
14 15 16	Probability to build at A 0.0 0.1	EMV A -2 -12 -9.5	EMV B 3.4 11 9.1	EMV A&B 1.4 -1 -0.4	EMV None 0 0		10							
14 15 16 17	Probability to build at A 0.0 0.1 0.2	EMV A -2 -12 -9.5 -7	EMV B 3.4 11 9.1 7.2	EMV A&B 1.4 -1 -0.4 0.2	EMV None 0 0 0 0		10							
14 15 16 17 18	Probability to build at A 0.0 0.1 0.2 0.3	EMV A -2 -12 -9.5 -7 -4.5	EMV B 3.4 11 9.1 7.2 5.3	EMV A&B 1.4 -1 -0.4 0.2 0.8	EMV None 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		10 5 - 0 }					*		
14 15 16 17 18 19	Probability to build at A 0.0 0.1 0.2 0.3 0.4	EMV A -2 -12 -9.5 -7 -4.5 -2	EMV B 3.4 11 9.1 7.2 5.3 3.4	EMV A&B 1.4 -1 -0.4 0.2 0.8 1.4	EMV None 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		10 5 - 0	0 0	.2	× 0.4	0.5	× →	× 1.0	1.2
14 15 16 17 18 19 20	Probability to build at A 0.0 0.1 0.2 0.3 0.4 0.5	EMV A -2 -12 -9.5 -7 -4.5 -2 0.5	EMV B 3.4 11 9.1 7.2 5.3 3.4 1.5	EMV A&B 1.4 -1 -0.4 0.2 0.8 1.4 2	EMV None 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		10 -5 - 0 -5 -	0 0	2	0.4	0.6	× 0.8	× 1.0	1.2
14 15 16 17 18 19 20 21	Probability to build at A 0.0 0.1 0.2 0.3 0.4 0.5 0.6	EMV A -2 -12 -9.5 -7 -4.5 -2 0.5 3	EMV B 3.4 11 9.1 7.2 5.3 3.4 1.5 -0.4	EMV A&B 1.4 -1 -0.4 0.2 0.8 1.4 2 2.6	EMV None 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		10 - 5 - 0 - 5 -	0 0	.2	0.4	0.6	0.8	1.0	1.2
14 15 16 17 18 19 20 21 22	Probability to build at A 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7	EMV A -2 -9.5 -7 -4.5 -2 0.5 3 5.5	EMV B 3.4 11 9.1 7.2 5.3 3.4 1.5 -0.4 -2.3	EMV A&B 1.4 -1 -0.4 0.2 0.8 1.4 2 2.6 3.2	EMV None 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		10 5 - 0 -5 -	0 0	2	₩ 0.4	0.5	0.8	1.0	1.2
14 15 16 17 18 19 20 21 22 23	Probability to build at A 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8	EMV A -2 -9.5 -7 -4.5 -2 0.5 3 5.5 8	EMV B 3.4 11 9.1 7.2 5.3 3.4 1.5 -0.4 -2.3 -4.2	EMV A&B 1.4 -1 -0.4 0.2 0.8 1.4 2 2.6 3.2 3.8	EMV None 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		10 5 - 0 -5 -	0 0	5.2 FMV A	-FMV B	0.6	0.8		 1.2
14 15 16 17 18 19 20 21 22 23 24	Probability to build at A 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9	EMV A -2 -12 -9.5 -7 -4.5 -2 0.5 3 5.5 8 10.5	EMV B 3.4 11 9.1 7.2 5.3 3.4 1.5 -0.4 -2.3 -4.2 -6.1	EMV A&B 1.4 -1 -0.4 0.2 0.8 1.4 2 2.6 3.2 3.8 4.4	EMV None 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		10 5 - 0 -10 -15	0 0	EMVA	EMV B	0.6	× 0.8 →	1.0	1.2
14 15 16 17 18 19 20 21 22 23 24 25	Probability to build at A 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0	EMV A -2 -12 -9.5 -7 -4.5 -2 0.5 3 5.5 8 10.5 13	EMV B 3.4 11 9.1 7.2 5.3 3.4 1.5 -0.4 -2.3 -4.2 -6.1 -8	EMV A&B 1.4 -1 -0.4 0.2 0.8 1.4 2 2.6 3.2 3.8 4.4 5	EMV None 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		10 5 0 0 -5 -10 -15	0 0	EMV A	eMV B Probabili	0.6	× 0.8 0.8 × A&B → at A	1.0	

(Decision.xls/Imns3SA)

How to set up sensitivity analysis with Excel Data Table for decision analysis

- 1 set up Payoff Matrix and Sensitivity Analysis Table as Given here
- 2 select cells A114 through E125
- 3 Click Data, Data Tools, What-if Analysis, Data Table
- 4 Specify B111 (prob. To build at A) as Column Input Cell
- 5 Click OK

Decision Tree

	А	В	С	D	E	F	G	Н
1		Parc	el of Land	Near Loc	ation			
2			Α	В				
3		Current purchase price	\$18	\$12				
4		Present value of future cash flows if hotel and airport are built at this location	\$31	\$23				
5		Present value of future sales price of parcel if the airport is not built at this location	\$6	\$4				
6								
7		P	ayoff Matr	ix				
8		Land Purchased	Airport is	Built at Lo	cation			
9		at Location(s)	А	В	EMV			
10		А	13	-12	-2			
11		В	-8	11	3.4	←Maximu	ım	
12		A&B	5	-1	1.4			
13		None	0	0	0			
14					=SUMPRC	DUCT(\$O\$	19:\$P\$19,C	14:P14)
15		prob (j).	0.4	0.6				

(Decision.xlsx/ImnsTree0)

How to build a Decision Tree with Excel@ TreePlan.xla?

- 1 To activate TreePlan, click Open/TreePlan.xla (be sure TreePlan.xla is on your computer)
- 2 To create a Decision Tree, click Add-Ins/Decision Tree to create a tree with two branches as default
- 3 with cursor point at decision node, click Decision Tree/add branch to add the third branch
- 4 with cursor point at decision node again, click Decision Tree/add branch to add the fourth branch
- 5 name the four tree branches according to the A, B, A&B and None
- 6 associate the costs of land purchases with respective branches using negatives
- 7 with cursor point at the end of each branch, click Decision Tree/change to event node with two events
- 8 name the two event branches as Airport Built at A or B respectively
- 9 match the probabilities for Airport Built at A and B respectively
- 10 associate the revenues of Buy Land A and Airport Built at A or B
- 11 with cursor point at the event node (Buy Land A and Airport Built at A or B, click Decision Tree/copy subtree/OK
- 12 with cursor point at the end of a branch where the new subtree to be connected, click Decision Tree/paste subtree/OK
- 13 repeat the process for the third branch
- 14 modify the probabilities and revenues associated with the event branches

	А	В	С	D	E	F	G	Н	1	J	K	l
1	To use Tree	Pla	in ad	ld ins, click (Office Buttor	n Oj	pen/	TrenPlan.xla	> Add-	Ins	/Decision	1
2	Click Add-Ir	<u>ns/[</u>	Decis	sion Tree to	start. For m	ore	inst	ructions, go	to Ragsdale	e pa	age 742	
3								0.4			Payoffs	
4								Airport Buil	t at A			
5							/				13	
6				Buy Land A				31	13			
7						Ο	$\langle \ $					
8				-18	-2			0.6				
9								Airport Buil	t at B			
10)				-12	
11								6	-12			
12												
13								0.4				
14								Airport Buil	tatA			
15							/				-8	
16				Buy Land B				4	-8			
17			1	50, 2010 5		\cap	(-					
18			\pm	-12	3.4	\sim	\setminus	0.6				
19			17				\langle	Airport Buil	tatB			
20			1/								11	
21		2	V –					23	11			
22	3.4	_	٨									
23	Max EMV		1/					0.4				
24			11					Airport Buil	tatA			
25			11								5	
26			\uparrow	Buy Land A	& B		1	35	5		-	
27			+			\cap	$\langle -$					
28			1	-30	1.4	\sim	\backslash	0.6				
29			1				$\langle \rangle$	Airport Buil	tatB			
30			1								-1	
31			1					29	-1		-	
32			1						_			
33			1									
34				None								
35											0	
36				0	0						_	

(Decision.xlsx/ImnsTree)

	А	В	С	D	E	F	G	Н	Ĩ	J	K	L
1		Expected Val	ue v	vith P	erfect Informa	tion (EVwPI)	1	-				
2												
3									Buy Land A			
4												13
5		8							13	13		
6		10 m						1				
7		1						1				
8								1	Buy Land B			
9		<u>8</u>			0.4			1				-8
10					Airport at Loc	ation A		1/	-8	-8		
11							1	K				
12					0	13		N				
13		8						11	Buy Lands A &	В		
14		<u> </u>		1			i	1	<u> </u>			5
15				1				1	5	5		
16				1				1				
17								1				
18				1					Buy None			
19				1								0
20				/					0	0		
21		0 3	0	(
22		11.8	-	1								
23				1					Buy Land A			
24				1						0		-12
25				1					-12	-12		
26				1				1				
27				1				1				
28				1				1	Buy Land B			
29		2		1	0.6			1				11
30		1.		. S	Airport at Loc	ation B	8	1/	11	11		
31							2	K				
32					0	11		1				
33					200			11	Buy Lands A &	В		
34								1				-1
35								1	-1	-1		
36								1				
37		2						1				
38		<u>j</u>						1 - U.	Buy None			
39												0
40									0	0		
(Deci	sio	n.xlsx/ImnsE\	/wP	1)								

4	Α	В	С	D	E		F	3	Н			J	K	L	М	Ν	0	Р	Q	R	S	T	U	V	W	Х	Ŷ
1	Multiple	Sta	ge D	ecision	Prob	oems	: Gra	ant P	roposa	l Exa	mpl	e on	Rags	dale p	age 751												
2																		0.6	5				Amount of the grant	85000			
3																		High R&D	Costs				Cost of proposal	0			
4																					21000						
5													М	icrowa	sve	_	/	(60000) 2100	0			Technology	Equipment Cost	-		
6													Г			-0							Microwave	(4000)		
7														4000	33000)	Į	0.4	ł				Cellular	(5000)		
8																	1	Low R&D	Costs				Infrared	(4000)		
9																	1				51000						
10																		(30000) 5100	0				Possible R&D Co	sts		
11																								Best Case (Low)		Worst Case (Hig	gh)
12																		0.1	2			ļ	Technology	Cost	Prob.	Cost	Prob.
13																		High R&D	Costs				Microwave	(30000)	0.4	(60000)	0.6
14									0.5								1				10000		Cellular	(40000)	0.8	(70000)	0.2
15								Re	ceive (Gran	t		Ce	llular		_	/	(70000) 1000	0			Infrared	(40000)	0.9	(80000)	0.1
16								Г				3				-0	(
17								8	35000	37	000			5000	34000)	Į	0.	3				Payoff Table without F	Proposal Cost			
18																	1	Low R&D	Costs				Technology	Low Cost	High Cost		
19																	1				40000		Microwave	51000	21000		
20																		(40000	4000	0			Cellular	40000	10000		
21																							Infrared	41000	1000		
22			_															0.:	l								
23																		High R&D	Costs					Receive Grant	Don't Receive (irant	
24				Submit P	ropo	sal											1				1000		Probability	0.5	0.5		
25			ſ			-(J						In	frared		~	/	(80000) 100	0							
26				0	18	500										-0											
27														4000	37000)	Į	0.9)								
28																	1	Low R&D	Costs								
29																	'				41000						
30																		(40000) 4100	0							
31																											
32		1							0.5																		
33	18500							Do	on't Rec	ceive	Gra	nt															
34																•••••					0						
35								_	0		0																
36			1					_																			
37			1																								
38				Don't Su	bmit	Prop	osal																				
39			L														••••				0						
40				0		0																					

Multiple Stage Decision Analysis:

(Decision.xls/MStageDA)

	Α	В	С	D	E	F	G	Н	1	J	K
1	Risk Profi	le f	or G	rant Propo	sal Exampl	e d	on R	agsdale pa	ge 753		
2				<u>-</u>				0.45			
3								Receive G	rand, Low	R&	D Costs
4											0
5							1	0	36000		
6											
7							/	0.05			
8				Submit Pro	oposal		/	Receive G	rand, High	R8	D Costs
9						0	(0
10				0	13500			0	-4000		
11											
12								0.5			
13			/					Don't Rece	eive Grant		
14		1	(0
15	13500							0	-5000		
16											
17											
18				Don't Subr	mit Propos	al					
19											0
20				0	0						

Develop Risk Profile:

(Decision.xls/Risk)

	A	В	С	D
1	Colonial Motors			
2		Factory Size	Building Cost(\$mil)	
3		Large	(25)	
4		Small	(15)	
5				
6	Payoff Table without Bui	ilding Cost (\$mil)		
7	Factory Size	High Demand	Low Demand	
8	Large	175	95	
9	Small	125	105	
10			•	
11	Payoff Table with Buildir	ng Cost (\$mil)		·•
12	Factory Size	High Demand	Low Demand	•
13	Large			
14	Small			
15				
16		High Demand	Low Demand	
17	Probability			
18				
19	EVwPI			
20	Max EMV		• •	
21	EVPI=EVwPI-Max EMV			
22		High Demand	Low Demand	•
23	Prior Probability			
24			•	
25	Conditional Probabilities	or Likelihood of S	urvey Results Given D	emand
26	P(Survey Rsps Dmd)	High Demand	Low Demand	
27	Favorable Rsp	0.857	0.223	
28	Unfavorable Rsp	0.143	0.777	
29	Sum Rsps(Col)	1.000	1.000	
30				
31	Joint Probabilities of Sur	vey Rsps and Dem	and	
32	P(Survey Rsps & Dmd)	High Demand	Low Demand	SumDmd(Row)
33	Favorable Rsp			
34	Unfavorable Rsp		•	
35	Sum Rsps(Col)		•	
36				
37	Posterior Probabilities of	f De mand G ive n S	urvey Response	•
38	P(Dmd Survey Rsps)	High Demand	Low Demand	SumDmd(Row)

Use of Sample Information in Decision Making: Colonial Moters example on Ragsdale page 760

(Decision.xlsx/CMBlank)

	А	В	С	D	E	F	G	Н	I.	J	K	L
1	Use of Sar	mpl	le In	formation in [Decision Ma	cin	g: Col	onial Mote	rs example	e o	n Ragsdale	page 760
2												
3								0.7				
4								High Dem	and			
5							/				150	
6				Build Large Pl	ant			175	150			
7						O	$\langle \dots \rangle$					
8				-25	126			0.3				
9								Low Dema	nd			
10							```				70	
11								95	70			
12		1										
13	126							0.7				
14								High Dem	and			
15							/				110	
16				Build Small P	lant	_	/	125	110			
17				L		O	$\langle $					
18				-15	104			0.3				
19								Low Dema	and			
20)				90	
21								105	90			

(Decision.xls/CMDA)

	А	В	С	D	E	F		G	н	- I	J	К	L
1		Expected	Val	ue۱	with Perfec	t Infor	mat	ior	n (EV	/wPI)			
2													
3										Large			
4					0.7				/				150
5					High Dema	and			/	150	150		
6					/			1	$\langle \$				
7				_/	0		150						
8										Small			
9				/					``				110
10				/						110	110		
11			\bigcirc										
12		132											
13										Large			
14					0.3				/				70
15					Low Dema	ind			/	70	70		
16								2	$\langle \dots \rangle$				
17					0		90						
18										Small			
19													90
20		L								90	90		

(Decision.xlsx/CMEVwPI)

	Α	В	С	D	E	F	G	н	1	J	K	L	M	Ν	0	Р	Q	R	S
3				ļ										ļ	ļ	0.9		ļ	
4		ļ				ļ	ļ			ļ	ļ			ļ	ļ	High Dem	and	ļ	
2		ļ				ļ	ļ			ļ	ļ			ļ	/			ļ	150
1		÷										Build Large	Plant	<u> </u>	ļ	1/5	150	·····	
8		÷									•/	-25	142	\sim	\	0.1		<u> </u>	
9		1		1							-/			·	1	Low Dema	ind	†	
10		1		<u>.</u>				0.67			1			<u> </u>	<u> </u>			Ĺ	70
11		ļ						Favorable			Į			ļ	ļ	95	70)	
12		ļ				ļ	ļ			1	Į							ļ	
14		ļ				ļ	•• 	0	142	ļ	ł					U.9			
15		†				·				·	÷					nigit Denk		į	110
16		<u>†</u>					-t				ŀ-\	Build Small	Plant	·	1	125	110	ļ	
17		1		1			1		•					\odot	Ć	••••••		1	
18				Į			1					-15	108	Į	Λ.	0.1		Į	
19		ļ	ļ		Į	ļ	IJ			ļ	ļ				7	Low Dema	ind	ļ	
20		ļ			1	ļ	ļ			ļ	ļ			ļ				ţ	90
22		÷		Conduc	t Survey											105	90) 	
23		<u> </u>		f	126.82	~	4							·····		0.3		÷	
24		<u>†</u>		ŀ			ł							·		High Dema	: and	†	
25		1		•	1		it:		•					·	, ,			ſ	150
26		1			<u>.</u>	<u>.</u>	î١.	••••••		<u>.</u>		Build Large	Plant		7	175	150	0	
27		ļ			Į	Į	ΙI.			ļ	İ,			O	ζ				
28		ļ				ļ				ļ	<i>j</i>	-25	94	ļ	λ.	0.7		ļ	
29		<u>.</u>						033		ļ	÷			ļ		Low Dema	ina	į	70
31		<u> </u>	-+-					Unfavoral	i. Ne		<i>.</i> /					05	70	1	
32		<u>†</u>	+							2	ť							·	
33		1	İ					0	96		١	•		[****		0.3		1	
34		ļ	[Į						1					High Dema	and		
35		ļ	ļ		ļ	ļ	ļ			ļ	/		L	ļ	,			Į	110
36		-	ļ				ļ			ļ		Build Small	Plant	5		125	110) 	
38	126.82	1-	 							ŀ		.15	06	\sim	\	07		÷	
39	120.02	••••	t –									-1-	30	•	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Low Dema	: and	÷	
40		†	t		<u>.</u>										····/			t	90
41		1	1		1	1	<u>.</u>	••••••		<u> </u>	1	•				105	90)	
42		Į	ļ.,		ļ	Į	Į			ļ	Į						ļ		
43		ļ	4							ļ	ļ	0.7		ļ	ļ			Ļ	
44		<u>.</u>	<u></u>		. .		ļ					nign Dema						÷	450
46		÷	-t-					Build Lare	i Plant		1	175	150	ļ				÷	150
47		÷								\cap	ť	612						·	
48						·)	-25	126		1	0.3	•					1	
49		ļ					1				Ń	Low Demar	nd						
50		ļ		į			/							ļ				ļ	70
51		ļ		No Surv	ey	_	Į					95	70	ļ	ļ			ļ	
52		÷		-	47.6	1	\											÷	
54		÷			120		÷\					U. / High Dema	i. nd				•	·	
55		÷	•		<u>.</u>	•	÷				•;		· · · · · · · · · · · · · · · · · · ·				••••••		110
56		1			1		١	Build Sma	ll Plant		7	125	110				••••••		
57		1			[[Ĩ	<u> </u>		\bigcirc	(
58								-15	104		7	0.3						ļ	
59		ļ					ļ			ļ	\	Low Demar	nd	ļ				ļ	
60		ļ					ļ			ļ	ļ			!				ļ	90
01		1		:								105	90	:				1	

(Decision.xlsx/CMEVSI)

	Z	AA	AB	AC			
37	Posterior Probabilities of Demand (Given Survey Response					
38	P (Dmd Survey Rsps)	High Demand	Low Demand	SumDmd(Row)			
39	Favorable Rsp	0.9	0.1	1			
40	Unfavorable Rsp	0.3	0.7	1			
41							
42	P (Demand Favorable)	0.9	0.1	Favorable Rsps			
43	Payoff Table with Building Cost (\$n	ni)					
44	Factory Size	High Demand	Low Demand	Favorable Rsps			
45	Large	150	70				
46	Small	110	90				
47							
48	P (Demand Unfavorable)	0.3	0.7	Unfavorable Rsps			
49	Payoff Table with Building Cost (\$n	ni)					
50	Factory Size	High Demand	Low Demand	Unfavorable Rsps			
51	Large	150	70				
52	Small	110	90				
53		•					
54		P(Favorable Rsp)	P(Unfavorable Rsp)				
55	Probability of Response	0.667	0.333				
56	Decision on Facility Size						
57				EVwSI			
58	Decision on Conduct Survey						
59							
60	Eexpected Value of Sample Inform	ation (EVSI) = EV with Sa	mple Info - Max EMV witho	ut Sample Info			
61		EVwSI	Max EMV	EVSI			
62	EVSI =						
63							
64	Effeciency of Sample Information =	E = EVSI/EVPI 100%=					
65							
66		EVwPI	Max EMV	EVPI			
67	EVPI = EVwPI - Max EMV =						
68							

(Decision.xlsx/CMEVwSI)