DECISION MODELS

Decisions Making Under Uncertainty

1. Max-Min Criteria (pessimist)
- Best of the worst
-Becomes (Min-Max) if loss table
A. Find min (max) in each row
B. Pick the best of the Max (Min)

Criteria Max-Max Criterion (Optimist)
-Best of the best
(min-min) if loss table
A. Find max (min) in each row
B. Pick the largest (smallest)

3. Weighted Average Criterion

nature - Coef. of Optimism = α
- Optimistic=1, pessimistic=0
A. Calculate weighted value
expected
α (best) + (1 - α) (worst)
B. Pick best value

4. Minimizing Regret

- Savage opportunity loss criteria
A. Set up opportunity loss matrix
- subtract the largest number in
each column from all other numbers
in that column

B. Find max regret in each row
C. Pick the action with min. regret.

Decisions Making Under Risk

1. Expected Payoff (Average)
A. Multiply payoffs by probabilities and
add up. (For each action separately)
B. Pick best action

2. Expected Opportunity Loss
A. Set up loss matrix
-Subtract all numbers in each column
from the largest number in that column
B. Find average opportunity loss Becomes
for each action.
- multiply the probability time loss and B.
add up.
C. Pick smallest number (want to min
loss)

3. Most Probable State of Nature

A. Determine the most probable state of
(one with highest probability)

B. Pick the action with the highest

payoff.
C. Good criteria for a non-repetitive
Decision

5. Expected Value of Perfect Information

A. Fix a state of nature.
B. Pick largest value in each column

C. Multiply prob. X largest values
and add up = ERPI
ERPI=Expected Return of Perfect Info)
D. EVPI = ERPI - Average expected payoff
E. EVPI is always equal to Expected
opportunity loss.

6. Equal Likely Strategy (Laplace Criterion)

- Best on Average
A. Expected payoffs for each row
B. Pick the largest (max problem) (Smallest for min problems)

Numerical Example

	State of Nature			
	(0.5)**	(0.3)**	(0.2)**	**Use Probabilities for Decision Under Risk Problems only.
Action	Growth	No Change	Inflation	
Bonds	12%	6%	3%	
Stocks	15%	3%	-2%	
Deposit	6.5%	6.5%	6.5%	

Note: Objective is to Maximize

DECISION MAKING UNDER PURE UNCERTAINTY

1. Max-Min (Pess)

Min/Row
3
-2
6.5 **

2. Max-Max (Opt)

Max/Row
12
15 **
6.5

3. Weighted Average

Action	Weighted Value (α = 0.7)
B	(.7) 12 + (.3)3 = 9.3
S	(.7) 15 + (.3)-2 = 9.9 **
D	(.7) 6.5 + (.3)6.5 = 6.5

Best Worst

4. Minimizing Regret

Opportunity Loss Matrix

Action	Growth	No Change	Inflation	Max/Row
Bonds	-3 (12-15)	-0.5	-3.5	-3.5 **
Stocks	0	-3.5	-8.5	-8.5
Dep.	-8.5	0	0	-8.5

5. Equal Likely Strategy (LaPlace)

	Action
Bonds**	7 **
Stocks	5.3
Deposit	6.5

DECISION MAKING UNDER RISK

1. Expected Payoff (Average)

Action	Average Payoff
** Bonds	(.5)12 + (.3)6 + (.2)3 = 8.4 **
Stocks	(.5)15 + (.3)3 + (.2)-2 = 8.0
Deposit	(.5)6.5 + (.3)6.5 + (.2)(6.5)= 6.5

2. Expected Opportunity Loss

Opportunity Loss (EOL) Matrix

Act	G (.5)	No (.3)	In (.2)	EOL
B**	3 (15-12)	0.5	3.5	2.35**
S	0	3.5	8.5	2.75
D	8.5	0	0	4.25

3. Most Probable State of Nature

Action	Growth (.5)
Bounds	12
Stocks	15**
Deposit	6.5

Note: EOL is the sum of the (prob.* loss)
3(.5) + .5(.3) + 3.5(.2) = 2.35
0(.5) + 3.5(.3) + 9.5(.2) = 2.75
8.5(.5) + 0(3) + 0(.2) = 4.25

4. Expected Value of Perfect Information

EVPI = ERPI - Average Expected Payoff

	Max Values from Each Column		
	Growth(.5)	No Change(.3)	Inflation(.2)
	15	6.5	6.5
ERPI=	15(.5) +	6.5(.3) +	6.5(.2) = 10.75

EVPI = 10.75 - 8.4 = 2.35%

If information costs more than 2.35%, don't buy it. If you invest $100.000 should you buy info for $15,000? 2.35% ($100,000) - $15,000 = -$12,650 => NO!

DECISION TREES (Bayesian Approach)

1. Evaluate the Decision with Prior Probabilities

	State of Nature		
Action	A (High Sales) (.2)	B (Medium Sales) (.5)	C (No Sales) (.3)
A1 (Develop)	3000	2000	-6000
A2 (Don't)	0	0	0

Prior EMV : Develop: (.2)3000 + (.5)2000 + (.3)(-6000) = -200

Prior EMV (Don't): 0 **

2. Acquire Some Reliable Info (Not Perfect Info Due To Uncertainty)

	GIVEN			
Predicted	A (High)	B (Medium)	C (Small)	
Ap	0.8	0.1	0.1	
Bp	0.1	0.9	0.2	Consultant is best at
Cp	0.1	0.0	0.7	Predicting medium sales.
Sum	1.0	1.0	1.0	

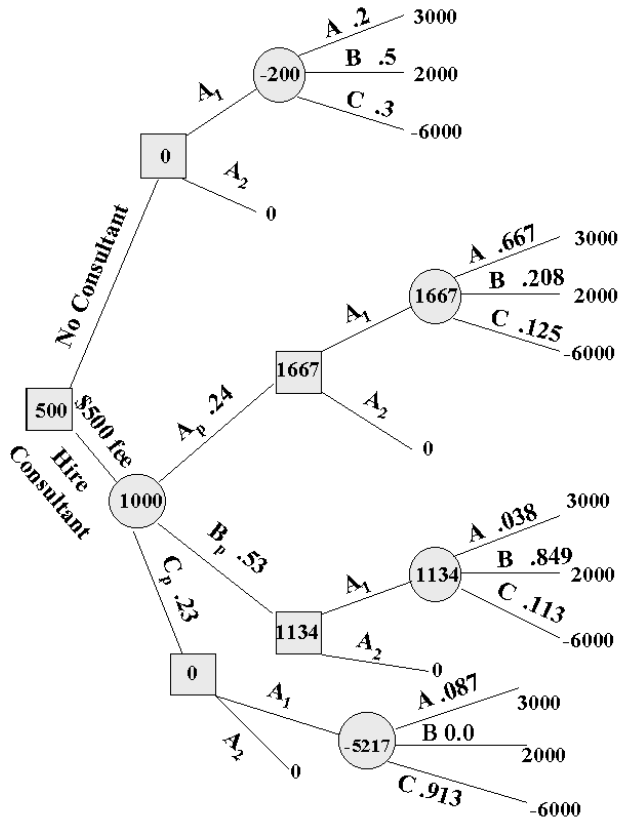
3. Revised (Posterior) Probabilities are Computed

	Predictions				
State of Nature	|Ap	Bp	Cp |	Prior Prob.	| Ap . P | Bp . P | Cp . P |
A	| .8	.1	.1 |	.2	| .16 | .02 | .02
B	| .1	.9	0 |	.5	| .05 | .45 | 0
C	| .1	.2	.7 |	.3	| .03 | .06 | .21
				Sum	| .24 | .53 | .23 add-up to 1
			0.2= P(Bp|C)		|.16/.24| .02/.53| .02/.23
Note: Table is inverted, now					|= .667 | = .038 | = .087
rows add to equal 1.					|.05/.24| .45/.53| 0/.23
See decision tree for use of values					|= .208 | = .849 | = 0
					|.03/.24| .06/.53 | .21/.23
			0.113=P(C|Bp)		|= .125 | = .113 | = .913
				Sum	1 1 1

4. Expected Values Are Computed: See decision tree

5. A decision is made regarding whether or not to acquire the additional info. Then a choice is made immediately.
6. If a decision is made to buy the info, then the research is undertaken only after that, based on the results of the research, is the selection of an alternative made.

7. Expected Value of Perfect Information
EVPI = EMV (with devil help) - EMV (without devil help)
EMV (without his help) = 0
EVPI= (.2)3000 + (.5)2000 + (.3)0 - 0 = 1600
Best outcomes for each state of nature.
Efficiency of the Consultant = Expected Payoff (using consultant)/EVPI = 1000/1600 = 62.5%



UTILITIES: Utility: Value of $ to you based on your risk profile.

	Fire (.0005)	No Fire (.9995)	Expected Utility
Insure	-1	-1	-1 **
Don't Ins.	-10,000 0	-5	

How to find Utility of $12

= (P) x Utility of $15 + (1-P) x Utility of -$2
- Find "P" where you are indifferent. Once you have few points, graph and interpolate all other utilities.