WFA8433-Natural Resource & Conservation Decision Making

Class 3 Decision trees and decision making under uncertainty; Being a decision maker

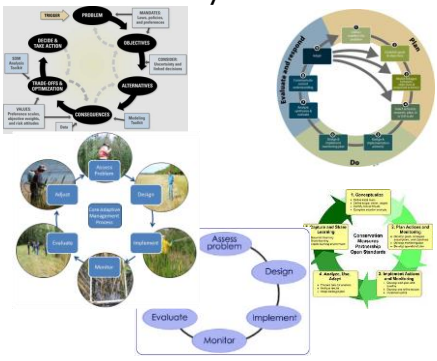
Housekeeping

- Suggested readings:
  - Smart Choices Chapters 7 & 8
- Assignment(s): None
- Group work: Discuss among class
  - Randomly assign???
  - Allow to form groups???

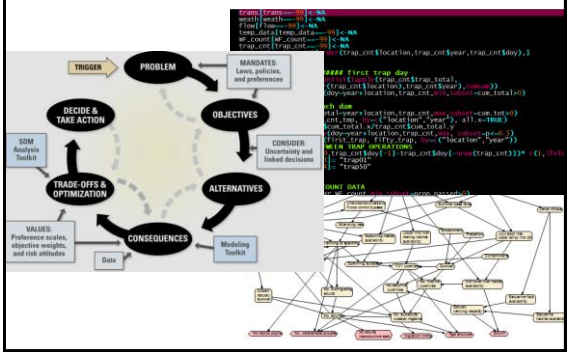
Website caching

- Chrome it does not check for the most current version of a site if you have previously visited.
- Use Shift F5 or press shift and the reload button.
- Other web browsers should behave.

Folksy to Formal



To a formal process…

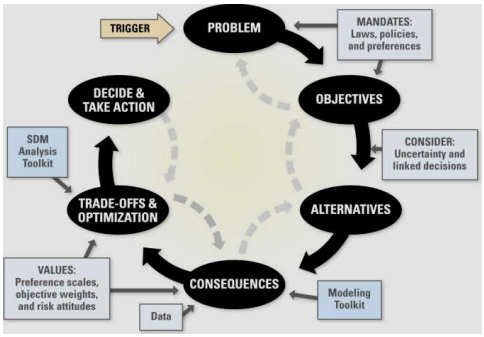


A management decision is an irrevocable commitment of resources!

Last class review

- PrOACT
- Folksy→ Formal Process

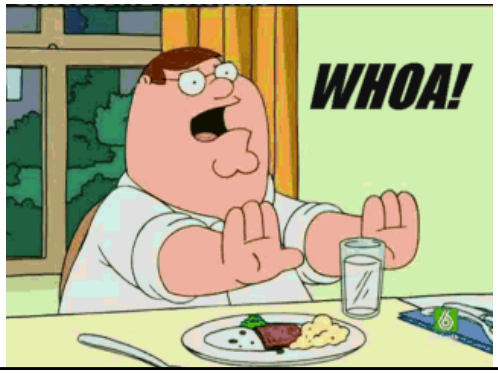
PrOACT



Problem

I need a car!

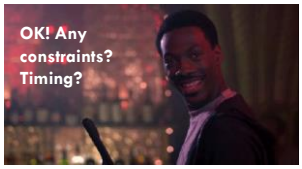
Woah- let's revise



What was the trigger

Problem V2

I need a car because mine was stolen and stripped for parts.



Problem V3

I need a car because mine was stolen and stripped for parts. A single, reliable, moderate mileage, car needs to be purchased that does not exceed my budget of 6k. The car must be purchased from a car dealer in Starkville.

Any uncertainty? If so can it be ignored?

Revisit and revise

I need a car because mine was stolen and stripped for parts. A single, reliable, moderate mileage, car needs to be purchased that does not exceed my budget of 6k. The car must be purchased from a car dealer in Starkville.

How is moderate defined?

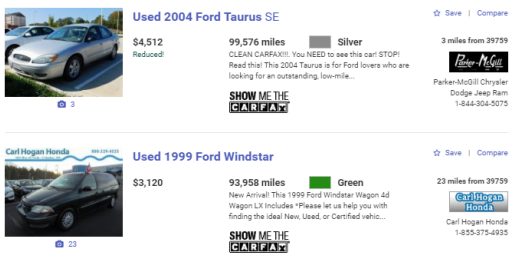
Problem V4

I need a car because mine was stolen and stripped for parts. A single, reliable, car with less than 150k miles needs to be purchased that does not exceed my budget of 6k. The car must be purchased from a car dealer in Starkville.

Objectives

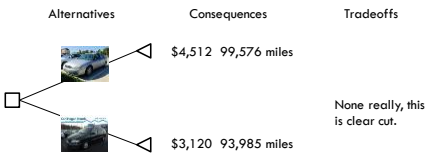
1. Minimize cost
2. Reliablity

Alternatives



Visualizing the decision

Visualizing the decision



There is no uncertainty… The consequences are certain

Because of uncertainty

- Good decision can have bad consequences
- Bad decision can have a good consequence

Which flight?

- Mark traveling with mom to London
- Plan to meet in DC to fly to London
  - Meet for dinner Saturday and fly out at 10pm
- ***Daughter has soccer game at 9 am Saturday!!!!!!***

Mark's Alternatives

1. Attend game and reschedule flight (cuts a day off of trip and costs $400)
2. Miss game and do original plan
3. Attend game and take later flight, if flight is less than 30 minutes late (no dinner)

Quantifying uncertainty

- Probability he will arrive no more than 30 minutes late
  - 80% on time (15 minutes or less)
- Likely higher
  - Traveling on Saturday-fewer delays
  - Most late flights are within 30 minutes
- Assigns a 90% chance of making flight

Risk and uncertainty

- 90% chance of making it
- 10% risk of not making it

Decision- go to game and catch later flight

Uncertainty and risk as probabilities

Outcomes & consequences must be:

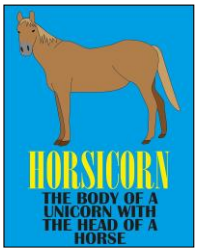
Mutually exclusive: no overlaps
Partly cloudy & partly sunny…

Collectively exhaustive: include all relevant possibilities, all possible contingencies

Unambiguously defined: if the weather was scattered showers was the weather rain or shine?

Natural resource situation

- We want to translocate this population of endangered horseicorns to a newly established refuge



Trigger

Gas extraction is fragmenting the current homerange

Alternatives

1. Move the horsicorns
2. Keep the horsicorns at current location

Objectives

1. Population persistence
2. Minimize future threats

Quantifying uncertainty

Alternative	Persistence	Future threat
Move	0.8	Low-refuge
Stay	0.4	High

No brainer- 20% chance of winking out versus 60%

Over simplification of uncertainty?

Risk and uncertainty

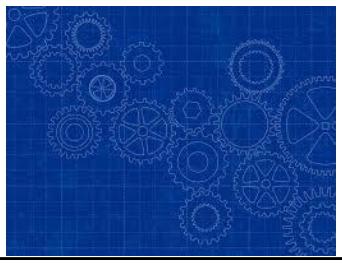
- 90% chance of making it
- 10% risk of not making it

Decision- go to game and catch later flight

All this seems a bit ad hoc

Multiple sources of uncertainty

- Risk profiles & Decision Trees
- Useful for explaining decision-a blueprint



Example – Picking a party

- Modified from Smart Choices page
- Jan wants to have get together for her employees

Objectives

1. Party to be fun
2. Family involvement
3. Reasonable cost

Alternatives

1. Picnic at a retreat w/ pool, ball field
2. Dinner and dance at downtown hotel


Uncertainty?

Weather influences meeting objectives


Versus


Versus


Consequences

Alternative	Weather	Fun	Family involvement	Expense
Hotel dance	Rain	Medium	Medium	12,500
	Shine	High	Medium	12,500
Outdoor picnic	Rain	Low	Low	7,000
	Shine	High	High	6,000

Best alternative?

Uncertainty & Consequences

Alternative	Weather	Fun	Family involvement	Expense
Hotel dance	Rain (0.3)	Medium	Medium	12,500
	Shine (0.7)	High	Medium	12,500
Outdoor picnic	Rain (0.3)	Low	Low	7,000
	Shine (0.7)	High	High	6,000

Still difficult to visualize process…

Visualizing the decision

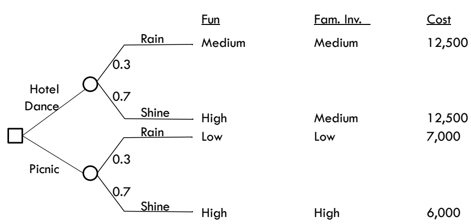
Some terminology and symbols

Decision node ○

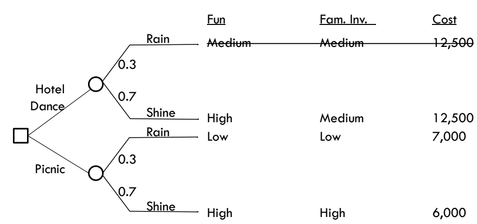
Uncertainty node □

Node-location where something happens

Visualizing the decision



Visualizing the decision



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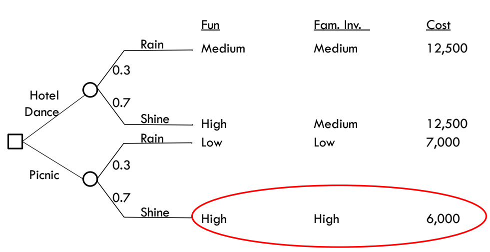


Even with 30% risk of rain the picnic meets the objectives

A natural resource example

Each year ODFW stocks trout to EE Wilson Game management area ponds to meet management objectives

Objectives

1. Minimize competition with native critters [*Ecology*]
2. Maximize angler satisfaction [*Human dimensions*]
3. Maximize filling bag limits [*Harvest*]

Alternatives

1. Stock 300 Trout
2. Stock 500 Trout
3. Stock 1000 Trout

Uncertainty- return to creel

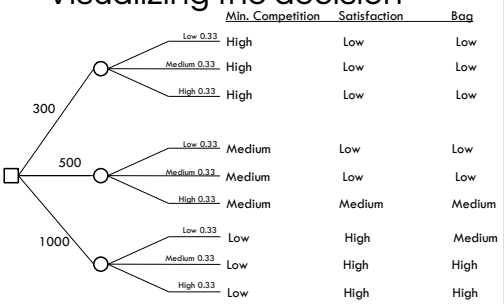
Return to creel – completely uncertain

Low – 0.33

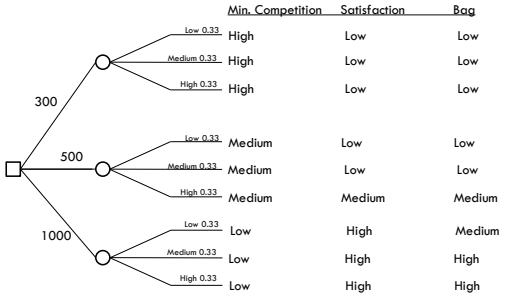
Medium – 0.33

High– 0.33

Visualizing the decision



What is the best decision?



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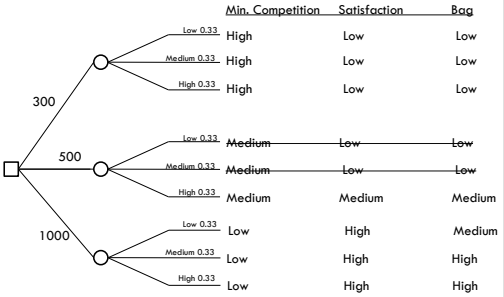

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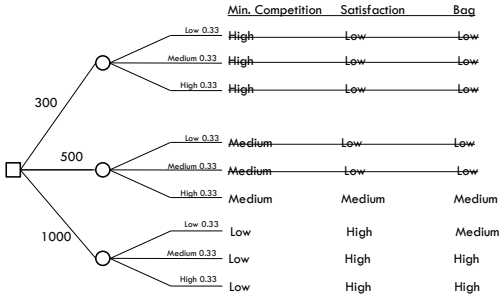

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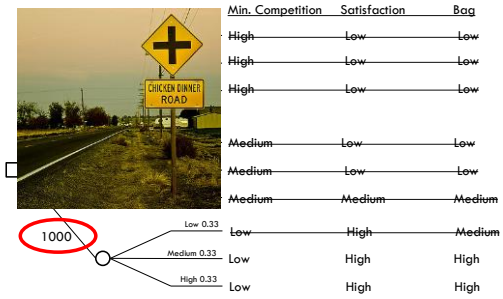

What if some information is known about return to creel?

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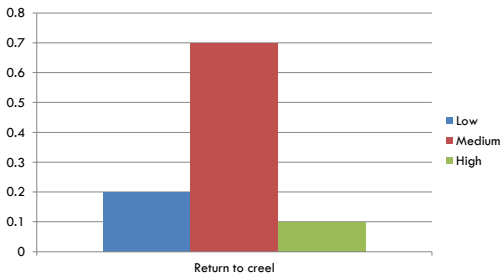

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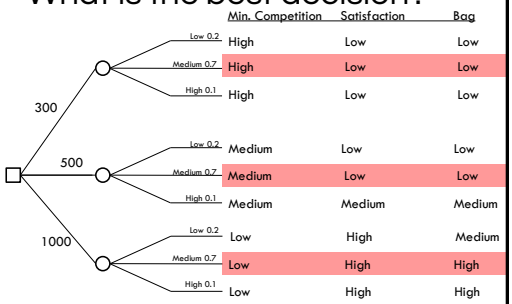

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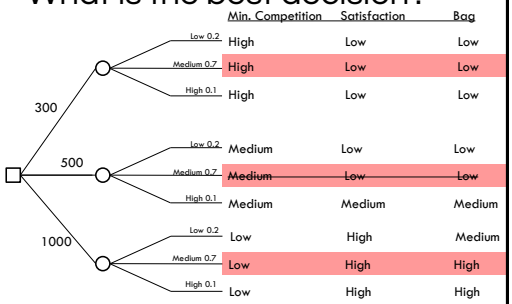


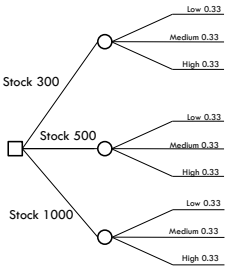
What is the best decision?

	Min. Competition	Satisfaction	Bag
	High	Low	Low
	~~High~~	~~Low~~	~~Low~~
	High	Low	Low
	Medium	Low	Low
	~~Medium~~	~~Low~~	~~Low~~
	Medium	Medium	Medium
1000	Low 0.2	Low	High	Medium
	Medium 0.7	Low	High	High
	High 0.1	Low	High	High

Mutually exclusive

- Uncertainty in return to creel
  - Low, Medium, High (mutually exclusive)
  - Would be better to quantify
    - Low 0 to 33%
    - Medium 33 to 66%
    - High 66 to 100%
- No overlap!

Collectively exhaustive



All possible combinations of decisions and uncertainties --- Collectively exhaustive

Ad hoc sensitivity

- Decision is robust to uncertainty in return to creel…
- Always stock 1000 rainbow trout
- Objectives drive the decision!!!

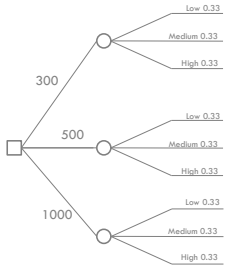
On being the decision maker

- Objectives drive the decision
- DO NOT HAVE TO CHOOSE THE BEST DECISION, BUT BE PREPARED TO DEFEND WHY YOU DIDN'T CHOOSE IT!
- Transparent process to use information, account for uncertainty and make decisions

RISK TOLERANCE

How well do you or stakeholers tolerate outcomes?

Ranking the outcomes



	Min. Competition	Satisfaction	Bag
	1. High	Low	Low
	2. High	Low	Low
	3. High	Low	Low
	4. Medium	Low	Low
	5. Medium	Low	Low
	6. Medium	Medium	Medium
	7. Low	High	Medium
	8. Low	High	High
	9. Low	High	High

Ranking the outcomes

Min. Competition	Satisfaction	Bag
8. Low	High	High
9. Low	High	High
7. Low	High	Medium
6. Medium	Medium	Medium
1. High	Low	Low
2. High	Low	Low
3. High	Low	Low
4. Medium	Low	Low
5. Medium	Low	Low

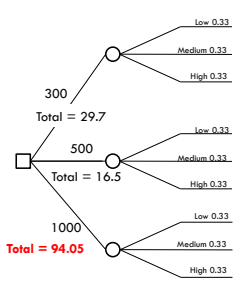
Scoring the outcomes

Min. Competition	Satisfaction	Bag	Score
8. Low	High	High	100
9. Low	High	High	100
7. Low	High	Medium	????
6. Medium	Medium	Medium	????
1. High	Low	Low	????
2. High	Low	Low	????
3. High	Low	Low	????
4. Medium	Low	Low	0
5. Medium	Low	Low	0

Scoring the outcomes

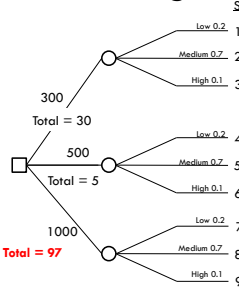
Min. Competition	Satisfaction	Bag	Score
8. Low	High	High	100
9. Low	High	High	100
7. Low	High	Medium	85
6. Medium	Medium	Medium	50
1. High	Low	Low	30
2. High	Low	Low	30
3. High	Low	Low	30
4. Medium	Low	Low	0
5. Medium	Low	Low	0

Ranking the outcomes



	Score	
	1. 30	30*0.33 = 9.9
	2. 30	30*0.33 = 9.9
	3. 30	30*0.33 = 9.9
	4. 0	0*0.33=0
	5. 0	0*0.33=0
	6. 50	50*0.33=16.5
	7. 85	85*0.33=28.05
	8. 100	100*0.33=33
	9. 100	100*0.33=33

Ranking the outcomes



	Score	
	1. 30	30*0.2 = 6
	2. 30	30*0.7 = 21
	3. 30	30*0.1 = 3
	4. 0	0*0.1=0
	5. 0	0*0.7=0
	6. 50	50*0.1=5
	7. 85	85*0.2=17
	8. 100	100*0.7=70
	9. 100	100*0.1=10

Decision is robust to uncertainty in creel returns (i.e., is the same decision even with new information

Key

- Quantifying objectives
- Challenging… to say the least
  - Costs, expenses, money
  - Formal elicitation of values (social science and human dimensions)
- Best to do early, prevents stakeholders from gaming the system

Key

- Objectives drives decision in a formal way
- Subtle but different than formulating decisions to meet objectives (black box)

Risk attitude of stakeholders