Decision Theory – Introduction

Elise Bonzon

elise.bonzon@mi.parisdescartes.fr

LIPADE - Université Paris Descartes
http://www.math-info.univ-paris5.fr/∽bonzon/

Decision making

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Decision making is the art of helping a decision maker to take a good decision

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Is deciding difficult?

Deciding can be difficult because...

Deciding can be difficult because...

- There are too many possibilities to decide

Deciding can be difficult because...

Deciding can be difficult because...

- There are too many possibilities to decide

For example:

- Which master I should choose?
- Classical problems: the Knapsack Problem (KP), the Travelling Salesman Problem (TSP), the Minimum Spanning Tree (MST)...

Combinatorial optimization

- Finding the best solution
- Into a finite set of objects
- Without any possibility to look at all of them !

Deciding can be difficult because...

Deciding can be difficult because...

- There are too many possibilities to decide
- There are several decision makers to decide

Deciding can be difficult because...

Deciding can be difficult because...

- There are too many possibilities to decide
- There are several decision makers to decide

For example:

- Where are we going to eat this evening?
- Classical problems: social choice theory

Social choice theory

- Knowing the preferences of every voter
- Finding the collective preferred solution

Deciding can be difficult because...

Deciding can be difficult because...

- There are too many possibilities to decide
- There are several decision makers to decide
- There are several criteria to be taken into consideration

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For example:

- Where should I go on vacation?
- Classical problems: multicriteria decision

Multicriteria decision

- Finding the global preferred solution
- With possibly conflicting criteria

Deciding can be difficult because...

Deciding can be difficult because...

- There are too many possibilities to decide
- There are several decision makers to decide
- There are several criteria to be taken into consideration
- Consequences are uncertain

Deciding can be difficult because...

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- There are too many possibilities to decide
- There are several decision makers to decide
- There are several criteria to be taken into consideration
- Consequences are uncertain

For example:

- Should I take my umbrella?
- Classical problems: Decision making under uncertainty

Let's play a game

Game 1

You win 100$

Game 2

- You win 0$ with $p = 0.5$
- You win 250$ with $p = 0.5$

Which game do you choose?

Let's play a game

Game 1

You win 10$

Game 2

- You win 0$ with $p = 0.5$
- You win 25$ with $p = 0.5$

Which game do you choose?

Let's play a game

Game 1

You win 100 000$

Game 2

- You win 0$ with $p = 0.5$
- You win 250 000$ with $p = 0.5$

Which game do you choose?

Decision under uncertainty

- Finding the global preferred solution
- Without knowing the exact consequences

Deciding can be difficult because...

Deciding can be difficult because...

- There are too many possibilities to decide → Combinatorial optimization
- There are several decision makers to decide → Social Choice Theory
- There are several criteria to be taken into consideration → Multicriteria Decision Analysis
- Consequences are uncertain → Decision under uncertainty

Plan (subject to change)

- Today, Preference modelling
- Tomorrow, Social Choice Theory
- Friday, Dec. 1st, Social Choice Theory/Multi-Criteria Decision Analysis
- Thursday, Dec. 14th, Multi-Criteria Decision Analysis
- Friday, Dec. 15th, Multi-Criteria Decision Analysis/Decision making under uncertainty
- Wednesday, Dec. 20th, Decision making under uncertainty