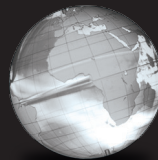


GLOBAL
EDITION



Foundations of Decision Analysis

Ronald A. Howard • Ali E. Abbas

ALWAYS LEARNING

PEARSON

Foundations of Decision Analysis

GLOBAL EDITION

Ronald A. Howard

Stanford University

Ali E. Abbas

University of Southern California

PEARSON

Boston Columbus Indianapolis New York San Francisco Hoboken
Amsterdam Cape Town Dubai London Madrid Milan Munich Paris Montréal Toronto
Delhi Mexico City São Paulo Sydney Hong Kong Seoul Singapore Taipei Tokyo

Foundations of Decision Analysis, Global Edition

Table of Contents

Cover

Title

Copyright

Brief Contents

Contents

Chapter 1: Introduction to Quality Decision Making

1.1 Introduction

1.2 Normative Vs. Descriptive

1.3 Declaring a Decision

1.4 Thought Vs. Action

1.5 What is a Decision?

1.6 Decision Vs. Outcome

1.7 Clarity of Action

1.8 What is a Good Decision?

1.9 Summary

Key Terms

Problems

Chapter 2: Experiencing a Decision

2.1 Introduction

2.2 Analysis of a Decision: The Thumbtack and the Medallion

Example

Table of Contents

2.3 Lessons Learned from the Thumbtack and Medallion Example

2.4 Summary

Key Terms

Appendix A: Results of the Thumbtack Demonstration

Problems

Chapter 3: Clarifying Values

3.1 Introduction

3.2 Value in Use and Value in Exchange

3.3 Values Around a Cycle of Ownership

3.4 Summary

Key Terms

Problems

Chapter 4: Precise Decision Language

4.1 Introduction

4.2 Lego-Like Precision

4.3 Precise Decision Language

4.4 Experts and Distinctions

4.5 Mastery

4.6 Creating Your Own Distinctions

4.7 Footnote

4.8 Summary

Key Terms

Problems

Chapter 5: Possibilities

5.1 Overview

5.2 Creating Distinctions

5.3 The Possibility Tree

Table of Contents

5.4 Measures

5.5 Summary

Key Terms

Problems

Chapter 6: Handling Uncertainty

6.1 Introduction

6.2 Describing Degree of Belief by Probability

6.3 The Probability Tree

6.4 Several Degrees of Distinction

6.5 Multiple Degrees of Distinction

6.6 Probability Trees Using Multiple Distinctions

6.7 Adding Measures to the Probability Tree

6.8 Multiple Measures

6.9 Summary

Key Terms

Appendix A: The Chain Rule for Distinctions: Calculating Elemental Probabilities

Appendix B: Lets Make a Deal Commentary

Appendix C: Further Discussion Related to the Example: At Least One Boy

Problems

Chapter 7: Relevance

7.1 Introduction

7.2 Relevance with Simple Distinctions

7.3 Is Relevance Mutual?

7.4 Relevance Diagrams

7.5 Alternate Assessment Orders

7.6 Relevance Depends on Knowledge

7.7 Distinctive Vs. Associative Logic

Table of Contents

7.8 The Third Factor

7.9 Multi-Degree Relevance

7.10 Summary

Key Terms

Appendix A: More on Relevance Diagrams and Arrow Reversals

Problems

Chapter 8: Rules of Actional Thought

8.1 Introduction

8.2 Using Rules for Decision Making

8.3 The Decision Situation

8.4 The Five Rules of Actional Thought

8.5 Summary

Key Terms

Problems

Chapter 9: The Party Problem

9.1 Introduction

9.2 The Party Problem

9.3 Simplifying the Rules: E-Value

9.4 Understanding the Value of the Party Problem

9.5 Summary

Key Terms

Appendix A

Problems

Chapter 10: Using a Value Measure

10.1 Introduction

10.2 Money as a Value Measure

10.3 u-curves

Table of Contents

10.4 Valuing Clairvoyance

10.5 Janes Party Problem

10.6 Attitudes toward Risk

10.7 Marys Party Problem

10.8 Summary

Key Terms

Problems

Chapter 11: Risk Attitude

11.1 Introduction

11.2 Wealth Risk Attitude

11.3 Buying and Selling a Deal Around a Cycle of Ownership

11.4 The Delta Property

11.5 Risk Odds

11.6 Delta Property Simplifications

11.7 Other Forms of Exponential u-Curve

11.8 Direct Assessment of Risk Tolerance

11.9 Summary

Key Terms

Problems

Chapter 12: Sensitivity Analysis

12.1 Introduction

12.2 Kims Sensitivity to Probability of Sunshine

12.3 Certain Equivalent Sensitivity

12.4 Value of Clairvoyance Sensitivity to Probability of Sunshine

12.5 Janes Sensitivity to Probability of Sunshine

12.6 Comparison of Kims and Janes Value of Clairvoyance Sensitivities

12.7 Risk Sensitivity Profile

Table of Contents

12.8 Summary

Key Terms

Problems

Chapter 13: Basic Information Gathering

13.1 Introduction

13.2 The Value of Information

13.3 The Acme Rain Detector

13.4 General Observations on Experiments

13.5 Asymmetric Experiments

13.6 Information Gathering Equivalents

13.7 Summary

Problems

Chapter 14: Decision Diagrams

14.1 Introduction

14.2 Nodes in the Decision Diagram

14.3 Arrows in Decision Diagrams

14.4 Value of Clairvoyance

14.5 Imperfect Information

14.6 Decision Tree Order

14.7 Detector Use Decision

14.8 Summary

Key Terms

Problems

Chapter 15: Encoding a Probability Distribution on a Measure

15.1 Introduction

15.2 Probability Encoding

15.3 Fractiles of a Probability Distribution

Table of Contents

15.4 Summary

Key Terms

Problems

Answers to Problem 2

Chapter 16: From Phenomenon to Assessment

16.1 Introduction

16.2 Information Transmission

16.3 Perception

16.4 Cognition

16.5 Motivation

16.6 Summary

Key Terms

Chapter 17: Framing a Decision

17.1 Introduction

17.2 Making a Decision

17.3 Selecting a Frame

17.4 Summary

Key Terms

Problems

Chapter 18: Valuing Information from Multiple Sources

18.1 Introduction

18.2 The Beta Rain Detector

18.3 Clarifying the Value of Joint Clairvoyance on Two Distinctions

18.4 Value of Information for Multiple Uncertainties

18.5 Approaching Clairvoyance with Multiple Acme Detectors

18.6 Valuing Individually Immaterial Multiple Detectors

18.7 Summary

Table of Contents

Key Terms

Problems

Chapter 19: Options

19.1 Introduction

19.2 Contractual and Non-Contractual Options

19.3 Option Price, Exercise Price, and Option Value

19.4 Simple Option Analysis

19.5 Consequences of Failure to Recognize Options

19.6 Janes Party Revisited

19.7 Value of Clairvoyance as an Option

19.8 Sequential Information Options

19.9 Sequential Detector Options

19.10 Creating Options

19.11 Summary

Key Terms

Problems

Chapter 20: Detectors with Multiple Indications

20.1 Introduction

20.2 Detector with 100 Indications

20.3 The Continuous Beta Detector

20.4 Summary

Key Terms

Problems

Chapter 21: Decisions with Influences

21.1 Introduction

21.2 Shirleys Problem

21.3 Summary

Table of Contents

Key Terms

Problems

Chapter 22: The Logarithmic u-Curve

22.1 Introduction

22.2 The Logarithmic u-Curve

22.3 Deals with Large Monetary Prospects for a DeltaPerson

22.4 Properties of the Logarithmic u-Curve

22.5 Certain Equivalent of Two Mutually Irrelevant Deal

22.6 The St. Petersburg Paradox

22.7 Summary

Key Terms

Appendix A: The Logarithmic Function and Its Properties

Appendix B: The Risk-Aversion Function

Appendix C: A Students Question Following an Economist Article

Problems

Chapter 23: The Linear Risk Tolerance u-Curve

23.1 Introduction

23.2 Linear Risk Tolerance

23.3 Summary

Key Terms

Appendix A: Derivation of Linear Risk Tolerance u-Curve

Appendix B: Students Problem Using Linear Risk Tolerance u-Curve

Problems

Chapter 24: Aproximate Expresions for the Certain Equivalent

24.1 Introduction

24.2 Moments of a Measure

24.3 Central Moments of a Measure

Table of Contents

24.4 Approximating the Certain Equivalent Using First and Second Central Moments

24.5 Approximating the Certain Equivalent Using Higher Order Moments

24.6 Cumulants

24.7 Summary

Key Terms

Problems

Chapter 25: Deterministic and Probabilistic Dominance

25.1 Introduction

25.2 Deterministic Dominance

25.3 First-Order Probabilistic Dominance

25.4 Second-Order Probabilistic Dominance

25.5 Dominance for Alternatives in the Party Problem

25.6 Summary

Key Terms

Problems

Chapter 26: Decisions with Multiple Attributes (1) Ordering Prospects with Preference and Value Functions

26.1 Introduction

26.2 Step 1: Direct Vs. Indirect Values

26.3 Step 2: Ordering Prospects Characterized by Multiple Direct Value Attributes

26.4 Summary

Key Terms

Appendix A: Deriving the Relation Between Increments in x and y as a Function of x in the Preference Function

Problems

Table of Contents

Chapter 27: Decisions with Multiple Attributes (2)Value Functions for Investment Cash Flows: Time Preference

27.1 Introduction

27.2 Rules for Evaluating Investment Cash Flows

27.3 Methods Not Equivalent to the Present Equivalent

27.4 Cash Flows: A Single Measure

27.5 Summary

Key Terms

Problems

Chapter 28: Decisions With Multiple Attributes (3)Preference Probabilities Over Value

28.1 Introduction

28.2 Stating Preference Probabilities with Two Attributes

28.3 Stating Preference Probabilities with a Value Function

28.4 Stating a u-Curve Over the Value Function

28.5 The Value Certain Equivalent

28.6 Other u-Function Approaches

28.7 Stating a u-Curve Over an Individual Attribute within the Value
Function

28.8 Valuing Uncertain Cash Flows

28.9 Discussion

28.10 Summary

Key Terms

Problems

Chapter 29: Betting on Disparate Belief

29.1 Introduction

29.2 Betting on Disparate Probabilities

Table of Contents

29.3 Practical Use

29.4 Summary

Key Terms

Problems

Chapter 30: Learning From Experimentation

30.1 Introduction

30.2 Assigning Probability of Head and Tail for the Thumbtack

30.3 Probability of Heads on Next Two Tosses

30.4 Probability of Any Number of Heads and Tails

30.5 Learning from Observation

30.6 Conjugate Distributions

30.7 Does Observing a Head Make the Probability of a Head on the
Next Toss More Likely?

30.8 Another Thumbtack Demonstration

30.9 Summary

Key Terms

Problems

Chapter 31: Auctions and Bidding

31.1 Introduction

31.2 Another Thumbtack Demonstration

31.3 Auctions 1 and 3 for a Deltaperson

31.4 Non-Deltaperson Analysis

31.5 The Value of the Bidding Opportunity for Auction 2

31.6 The Winners Curse

31.7 Summary

Key Terms

Problems

Table of Contents

Chapter 32: Evaluating, Scaling, and Sharing Uncertain Deals

32.1 Introduction

32.2 Scaling and Sharing Risk

32.3 Scaling an Uncertain Deal

32.4 Risk Sharing of Uncertain Deals

32.5 Optimal Investment in a Portfolio

32.6 Summary

Key Terms

Appendix A: Covariance and Correlation

Appendix B: Scalar (Dot) Product of Vectors

Appendix C: 2×2 and 3×3 Matrix Multiplications and Matrix Inversion

Problems

Chapter 33: Making Risky Decisions

33.1 Introduction

33.2 A Painful Dilemma

33.3 Small Probabilities

33.4 Using Micromort Values

33.5 Applications

33.6 Facing Larger Probabilities of Death

33.7 Summary

Key Terms

Problems

Chapter 34: Decisions with a High Probability of Death

34.1 Introduction

34.2 Value Function for Remaining Life Years and Consumption

34.3 Assigning a u-Curve Over the Value Function

34.4 Determining Micromort Values

Table of Contents

34.5 Equivalent Perfect Life Probability (EPIP)

34.6 Summary

Key Terms

Appendix A: Mortality Table for 30-Year-Old Male

Appendix B: Example of a Black Pill Calculation, $x = 10,000$

Appendix C: Example of a White Pill Calculation, $x = 10,000$

Problems

Chapter 35: Discretizing Continuous Probability Distributions

35.1 Introduction

35.2 Equal Areas Method

35.3 Caution with Discretization

35.4 Accuracy of 105090 Approximate Method for Equal Areas

35.5 Moments of Discrete and Continuous Measures

35.6 Moment Matching Method

35.7 Summary

Key Terms

Appendix A: Rationale for Equal Areas Method

Problems

Chapter 36: Solving Decision Problems by Simulation

36.1 Introduction

36.2 Using Simulation for Solving Problems

36.3 Simulating Decisions Having a Single Discrete Distinction

36.4 Decisions with Multiple Discrete Distinctions

36.5 Simulating a Measure with a Continuous Distribution

36.6 Simulating Mutually Irrelevant Distinctions

36.7 Value of Information with Simulation

36.8 Simulating Multiple Distinctions with Relevance

Table of Contents

36.9 Summary

Key Terms

Problems

Chapter 37: The Decision Analysis Cycle

37.1 Introduction

37.2 The Decision Analysis Cycle

37.3 The Model Sequence

37.4 Summary

Key Terms

Appendix A: Open Loop and Closed Loop Sensitivity for the Bidding
Decision

Chapter 38: Topics in Organizational Decision Making

38.1 Introduction

38.2 Operating to Maximize Value

38.3 Issues When Operating with Budgets

38.4 Issues with Incentive Structures

38.5 A Common Issue: Multiple Specifications Vs. Tradeoffs

38.6 Need for a Corporate Risk Tolerance

38.7 Common Motivational Biases in Organizations

38.8 Summary

Key Terms

Problems

Chapter 39: Coordinating the Decision Making of Large Groups

39.1 Introduction

39.2 Issues Contributing to Poor Group Decision Making

39.3 Classifying Decision Problems

Table of Contents

39.4 Structuring Decision Problems within Organizations

39.5 Example: The Fifth Generation Corvette

39.6 Summary

Key Terms

Chapter 40: Decisions and Ethics

40.1 Introduction

40.2 The Role of Ethics in Decision Making

40.3 Ethical Distinctions

40.4 Harming, Stealing, and Truth Telling

40.5 Ethical Codes

40.6 Ethical Situations

40.7 Summary

Key Terms

Problems

Index