

Quantitative Module A

Decision-Making Tools

Background

The decision-making tools presented in this module are all relatively simple to apply, but at the same time, they can really help to facilitate logical thinking. The tools can be applied to many environments discussed in the textbook chapters.

An important assumption of decision trees is that they assume risk-neutral behaviour. That is, the combination of alternatives that leads to the highest expected monetary value will be chosen, regardless of potential risks of large losses. Instructors can allude to this assumption at various points in the lecture to explore under what conditions it may not make sense. They can mention that various approaches to incorporating risk are available. One idea is to create a utility function based on the decision maker's risk preferences and then choose the combination of alternatives that maximize utility.

Class Discussion Ideas

1. Present a couple of ethical dilemmas (perhaps from earlier chapters in the text) and have a discussion about each. Then use the decision tree for ethical dilemmas that follows to analyze the dilemmas. Did it help? Were any different conclusions drawn after using that decision tree?

Active Classroom Learning Exercises

1. Have the students develop a decision tree that models their educational options and decisions. With their help select two or three possible undergraduate majors with different earnings potential. Give the students the options of pursuing graduate degrees, again with different earnings potential. After one run through the numbers suggesting that all students should pursue graduate degrees, ask them why all students will actually *not* pursue graduate degrees. Different issues will arise, some of which may be able to be incorporated into the tree. Examples might include: "I'm sick of school," "You forgot to include two years of forgone income plus the tuition expense of graduate school," "My girlfriend will leave me and I won't be able to marry her so I'll lose all of her potential income," "Too many people have graduate degrees now, so they have lost their lustre," "I don't want to maximize my future wealth—I'm all about work-life balance," etc.

Additional Assignment Ideas

1. Visit the websites of two decision-tree software products and describe the features. Provide screen captures with the report. Here are two possible starting places:
 - <http://www.treeage.com>
 - <http://www.palisade.com.au> (Search: Precision Tree)

Additional Case Studies

Internet Case Study (on MyOMLab)

- *Arctic, Inc.*: A refrigeration company has several major options with regard to capacity and expansion.
- *Ski Right Corp.*: Which of four manufacturers should be selected to manufacture ski helmets?

Richard Ivey School of Business (<https://www.iveycases.com/>)

- *Lockhurst Hotels International* (9A83D004): The vice president of Canadian operations of Lockhurst Hotels International is faced with the following decision. His director of Ontario operations had received an offer of employment with another hotel chain at an increase in salary of \$15,000 per year. The VP wondered what action, if any, he should take.

MyOMLab Resources

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Other Supplementary Material

Other Methods for Decision Making under Uncertainty

1. *The Hurwicz Criterion*

Maximax is purely optimistic while maximin is purely pessimistic. But what if the decision maker is somewhere in between? The Hurwicz criterion tries to provide a balance.

Determine a *coefficient of optimism* α , which lies between 0 and 1. For each row in the payoff table, compute α times the maximum payoff plus $(1 - \alpha)$ times the minimum payoff. Choose the alternative yielding the best (maximum) of these Hurwicz calculations.

Higher values of α implies that the decision maker is “more optimistic.” The Hurwicz criterion is equivalent to maximin when $\alpha = 0$ and maximax when $\alpha = 1$. A “half-optimistic” decision maker would use $\alpha = 0.5$.

2. *Minimax Regret*

This method is slightly more involved than most other methods for decision making with uncertainty. This approach appeals to the decision maker who does not want to feel too bad (regretful) afterwards about whatever decision was made.

The first step is to create a new parallel table called a *regret table*. The table computes the opportunity cost for each alternative under each state of nature. The regret in any cell equals the best possible payoff from that column in the payoff table minus the payoff of that particular alternative. (The best alternative for a particular state of nature will have a regret of 0 in its cell.) After the regret table is created, find the maximum regret in each row. Finally, choose the alternative that has the smallest of these maximum regrets.

Minimax regret represents an attempt at providing a *robust* solution that will never perform too badly, no matter what the outcome.