Influence Diagrams, Belief Nets and Decision Analysis
ROBERT M. OLIVER and JAMES Q. SMITH (Editors)
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In 1988 I wrote[1] in a collection of readings on decision analysis: 'We shall not discuss influence diagrams here because, in my opinion, they have yet to prove their worth.' Now, I guess, is as good a time as any to begin eating my words. At the same time as I was dismissing the worth of influence diagrams, a conference was being held at the University of California at Berkeley at which very many eminent workers in the fields of decision analysis, statistics and artificial intelligence gave the lie to my words.

Influence diagrams are a method for building uncertainty models in which their probabilistic independence and dependence structure is immediately apparent. They are also known as belief networks or, as Prof. R. A. Howard argues in the first paper of this collection might be a better term, relevance diagrams. There are many parallels between these diagrams and the idea of cognitive maps which are found throughout the operational research literature.[2] Those who work with cognitive maps have found that their manner of representing the many factors, concerns and issues that arise in tackling strategic problems is particularly intuitive to management. Influence diagrams allow this intuitive acceptability of cognitive maps to be combined with the technical apparatus of decision analysis. Thus there is the promise that the 'harder', more quantitative formalisms of subjective probability and multi-attribute utility can be combined into a coherent, complete analysis with the 'softer' aspects of decision aiding.

Seven papers in this collection look at applications ranging from risk analysis to machine monitoring and from environmental problems to medical decision making. Reading them has more than persuaded me of the worth of influence diagrams. True there are still technical problems, yet to be solved. The computations that are required in an analysis based on influence diagrams are not easy. Several papers in this collection describe and address those problems. Moreover, there are circumstances in which the more traditional formalism of decision trees is more appropriate than influence diagrams. What I find particularly exciting a prospect is the present growth in software tools that allow one to switch between decision tree and influence diagram representations of the same problem.

Bob Oliver and Jim Smith have edited the conference proceedings into a very valuable book. The great value of these proceedings arises not only because of the high quality of each of the 19 papers, but also because discussion of each paper has been included. Each paper is followed by one or more pertinent critiques together with a reply by the authors. Why cannot other conference proceedings follow this model?

Most of the papers are accessible to anyone with a moderate knowledge of probability: in all other respects the collection is, by and large, self-contained. The first two papers provide a layman's introduction to influence diagrams. Overall this is an excellent book: a mite expensive perhaps, but well worth the expenditure on library budgets. Certainly anyone claiming to work or teach in the fields of decision analysis, uncertainty modelling or artificial intelligence should read this book.

SIMON FRENCH

References

1. SIMON FRENCH (Ed.) *Readings in Decision Analysis* Chapman and Hall, London, 1989.
2. JONATHAN ROSENHEAD (Ed.) *Rational Analysis in a Problematic World*, John Wiley and Sons, Chichester, 1989.

Real Analysis and Probability
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Wadsworth, Pacific Grove, California, 1989. 436 pp. £18.95
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It seems to me that over the past 25 years operational research has changed significantly. In particular, there is now an area that is clearly devoted to the use of advanced mathematical concepts. One reason why this has occurred is our ability to gain real insight into intertemporal decision-making under uncertainty problems because of developments in stochastic process theory and its applications. However, there has been a cost associated with this success—increasing