Martin J. Beckman

DYNAMIC PROGRAMMING OF ECONOMIC DECISIONS

Springer-Verlag, Berlin, Heidelberg, New York 1968, 143 pp.

The book of M. J. Beckmann, one of the best-known specialists in operational research, aims to analyze the manner in which the methods of dynamic programming are to be used in reaching economic decisions.

By the manner in which he deals with the problems, the author succeeds in blending in a brilliant manner the mathematical strictness which characterizes his works, with a clear style, sometimes even didactic, which renders the book also accessible to economists having more reduced mathematical training.

This work contains both problems of decisions with discrete variables and problems with continuous variables.

Another merit of the work, which should be stressed, is the fact that all the notions and concepts used in it are accurately defined. In addition, the author classifies decisions in a manner that is also very useful in other applications.

The same scientific content and clear explanation characterizes the manner in which decision problems are dealt with in the case where the system analyzed is completely described by the transit probabilities. After the basic notions to be used are also introduced for this case, the optimum principle and a series of stability properties are given.

The author grants considerable space to applications in the domain of inventory control. Several variants of the following model are analyzed in the book:

$$\Phi(y) = \min_{x \geqslant 0} \left[R\delta(x) + cx + f_{x+y} + \rho \sum_{i=0}^{\infty} \Phi(x + y - i)\, p_i \right.$$

where

$$R\delta(x) + cx + by$$

is the total expected cost in a period with initial stock y and mean risk x,

$$\sum_{i=0}^{\infty} \Phi(x + y - i)\, p_i$$

is the expected value, ρ the discount factor, and p_i denotes the demand probability in the next period for i units.

An interesting case where the problem of risk is treated by adaptive programming methods is the one where transition probabilities have the form:

$$p_{ij}^{k} = p_{k(i)-j}$$

where i is the inventory level at the beginning of the period, k the inventory after stock replenishment, and $k - j$ is the demand.

The author also deals with the continuous decision variable, starting with the analysis of a simple allocation problem, then passing on to the general case. The properties of the solutions are analyzed in detail.

It should be noticed that a special paragraph is devoted to the analysis of a rather frequent case met particularly in macro-economic analysis, namely the one where the criterion function is quadratic.

Approaching the topic of continuous time decision processes the author judiciously insists on the applications and illustrations regarding re-location, and continuous time inventory control.

On the whole, this work constitutes a fundamental book for practitioners anxious to get acquainted with the theoretical bases and the mode of application of dynamic programming in reaching economic decisions.

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