ABSTRACT

Controlling and maintaining inventories of physical goods has always been an essential issue for every organization in any sector of the economy. A decision-making process is useful to find the appropriate policy for controlling and maintaining the inventories of the organization. In any decision-making problem (indeed inventory control, also), a suitable mathematical framework is required to analyze the decision process. When formulating a mathematical framework of an inventory control problem which closely captures the realistic economic situations, it is necessary to acquire the information regarding the parameters of the inventory system as much as possible. But, some or all parameters of a realistic inventory system are in general non-deterministic or uncertain. There are mainly two types of uncertainty, namely uncertainty due to impreciseness or fuzziness and uncertainty due to randomness arising simultaneously in any real-life inventory system. It is very appropriate and significant to capture the uncertainty of any real-life inventory system by a combination of fuzziness and randomness rather than either fuzziness or randomness. In such a decision-making situation, the conventional approaches of inventory control problem, such as adeterministicor probabilistic or even a fuzzy approach, cannotal ways be applied. Theobjectiveofthepresentthesisis, therefore, to explore the applicability of fuzzy random framework approach in developing mathematical models for realistic inventory problems. Inanalogytothewell-knownclassicaldefinitionofdefectiverates,type-Iandtype-II inspection errors in an inventory system; fuzzy defective rates, fuzzy type-I, and typeII errors are introduced in such a way that the parameters of the distribution function are not known precisely. The developed ideas are applied to analyze an economic production quantity model with imperfect production and screening process. On the other hand, continuous and periodic review inventory systems are extended in the fuzzy random environment by considering variable lead-time and backorder rate. The lead-time crashing cost is considered as a negative exponential function of the lead-time in both cases. The backorder discount and a constraint on the budget are incorporated into the periodic and continuous review inventory model, respectively. Moreover, service level constraint is extended in the fuzzy random framework, which is used to establish a continuousreviewinventorymodelinthepresenceoffuzzyrandomdemandaswellascost parameters. Finally, the min-max distribution-free procedure is employed to obtain the optimaldecisioninthefuzzyrandomframeworkunderthecontinuousreviewinventory system and continuous review production inventory system in which the distribution of lead-time demand is known partially. Various suitable mathematical methods are formulated for finding optimal decision policies. Numerical illustrations are carried out throughout the thesis to analyze the developed methodologies.

Keywords: Inventorycontrol,Imprecision,Uncertainty,Fuzzyrandomvariable,Economic production quantity, Periodic review, Continuous review, Imperfect quality, Inspection errors, Fuzzy inequality, Distribution-free procedure.