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Some New Dynamic Economic Lot Sizing Models

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Abstract. We introduce a dynamic economic lot sizing problem which takes into account both the production setup cost and the designed-and-yet stretchable production capacity. Demands and the control on production activities drive the evolution of the production system. We give a pseudo-polynomial algorithm for the problem when future demands are known. When there is uncertainty in future demands and there is no holding of inventory, we propose a two-layered solution process which makes the demand acceptance decision first and decides the level of production next. We also construct a mixed model which combines the features of both deterministic and stochastic models. The model not only utilizes currently-known information but also anticipates for the future. Our simulation study demonstrates the advantage of the mixed model.
Keywords. Lot Sizing; Pesudo-polynomial Algorithm; Just-in-Time; Dynamic Programming; Successive Approximation; Computer Simulation.

1 Introduction

The dynamic economic lot sizing (DELS) problem aims at the optimal dynamic control of production activities in a certain time horizon for a production system which faces exogenous demands. Here, we study a single-item DELS problem where the production cost is neither concave nor convex. To produce a certain quantity of items in one period, a setup cost S is incurred and the unit production cost depends on whether or not the quantity has exceeded the "soft" capacity X of the production system. The unit cost is F_L when the capacity is not exceeded and F_H when it is, where $F_L < F_H$. The soft capacity X reflects that the system has a designed production capacity and yet it is not unsurpassable with extra efforts being taken. Also, there is a we holding cost with rate E and a linear backlogging cost with rate L.

Most widely-studied DELS problems consider cases where production cost is either concave or convex. Wagner and Whitin [19] gave an $O(T^2)$ solution to a restricted version of the concave-cost DELS problem. Veinott [16], Zabel [20], Eppen, Gould, and Pashigian [7], Zangwill [21], Blackburn and Kunreuther [5], Lundin and Mortin [11], and Morton [13] all made generalizations to the $O(T^2)$ result. Federgruen and Tzur [8], Wagelmans, van