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A comment on 'A new method for joint replenishment problems' by Fung and Ma

Fung and Ma¹ proposed two algorithms for determining the optimal policy for the joint replenishment inventory problems. They conducted numerical experiments on randomly generated problems to demonstrate that their algorithms outperform the existing algorithms for almost all of the test problems.

Whenever a number of items are jointly replenished, a major set-up cost, which is independent of the number of items ordered, is involved and a minor setup cost is incurred for each individual item on order. The objective is to minimize the total relevant cost per unit of time of the system. The procedure for determining the optimal policy for items jointly replenished was first described in Goyal.² The procedure required determining the lower bound and the upper bound of the basic cycle time and then evaluating all alternative policies within the bounds and selecting the policy with lowest total relevant cost. The resulting inventory policy required that each major setup is undertaken at equal time intervals as well as the minor setup cost for each item is undertaken at equal time intervals. Fung and Ma¹ identified such a policy as *Goyal1* in their paper.

Andres and Emmons³ in their note on Goyal² showed with the help of a two-item example that it may not be economical to incur each major setup cost at equal time intervals. However, in their example the major setup cost was only 2% of the minor setup cost for individual items. Hence, it is not surprising that *Goyal1* provided a sub-optimal policy. In the extreme case when the major setup cost is almost zero, then it may indeed be more economical to order each item individually.

Van Eijis,⁴ in response to the observation made by Andres and Emmons, suggested a still lower bound as compared to the one suggested by Goyal.² Fung and Ma¹ found the algorithm based on the bounds proposed by Van Eijis⁴ computationally expensive.

Fung and Ma¹ describe *Goyal2* as the algorithm having lower bound which is $(1/\sqrt{2})$ of the lower bound as given in *Goyal1*. In their experimentation Fung and Ma¹ give results for the algorithm suggested by Viswanathan⁵ as well as the algorithms described by them as *Imp.1* and *Imp.2*.

It seems that Goyal,⁶ which described a simple procedure for tightening the bounds, as given in Goyal,² escaped the attention of Fung and Ma¹ and others. If the procedure given in Goyal⁶ is used to obtain the lower bound and the upper bound of the basic cycle time for the example given Goyal,² then one needs to evaluate only 9 intervals for *Goyal1* and 25 intervals for *Goyal2*. As per Table 1 of Fung and Ma¹ the number of intervals considered by them is 20 and 42 for *Goyal1* and *Goyal2* respectively.

Although personally I found the algorithms of Fung and Ma¹ interesting. I suspect that I will find it difficult to teach them even to my well intentioned and highly motivated graduate students. I leave it to the readers to draw their own conclusions.

References

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