Picking location metrics for order batching on a unidirectional cyclical picking line

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Abstract

Order batching is extended to a picking system with the layout of a unidirectional cyclical picking line. The objective is to minimise walking distance expressed as the number of cycles traversed by pickers in the picking line. The set up of the picking system shows similarities to unidirectional carousel systems, if the store keeping units are viewed as moving relative to a static picker.

As a first step, three order-to-route closeness metrics are introduced to approximate distance. All metrics are based on the picking location describing when a picker has to stop at a bay to collect the items for an order. These metrics comprise a number of stops, a number of non-identical stops and a stops ratio measurement.
Besides exact solution approaches, four greedy heuristics and six metaheuristics are applied to combine similar orders in batches.

All metrics are tested using real life data of 50 sample picking lines in a distribution centre of a prominent South African retailer. The capacity of the picking device is restricted, thus the maximum batch size of two orders per batch is allowed. The best combination of metric and solution approach is investigated. The significance of metric and cycles traversed is determined by a Welch-ANOVA, while the additional impact of the algorithms is investigated in a two-way ANOVA. Results show that the combination of stops ratio metric and greedy random heuristic generate the best results in terms of minimum number of total cycles traversed as well as computational time to find the solution.

Keywords: order batching, picking location metrics, unidirectional cyclical picking line, carousel

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