BACHELOR FINAL PROJECT

EINDHOVEN UNIVERSITY OF TECHNOLOGY
Department of Mechanical Engineering
Systems Engineering Group

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Student

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Start	September 2009
Finish	
Title	Matching of Products to Boxes

Subject

The packaging floor of a shipping company is responsible for packaging products into boxes. It handles N product types, labeled $i = 1,\ldots,N$ and uses M box types labeled $j = 1,\ldots,M$. The packaging floor has no control over which products and boxes it receives since product arrivals are based on customer orders and the box arrivals are by-products of other independent departments of the company. Every minute a new product and new box arrive. It is known that the proportion of products of type i that arrives is α_i and the proportion of type j boxes that arrive is β_j ($\alpha_i, \beta_j > 0$, $\sum_{i=1}^{N} \alpha_i = 1$ and $\sum_{i=j}^{M} \beta_j = 1$). There are strict rules with regards to matching of products to boxes. These are given by a set G, consisting of unordered pairs (i, j) which indicate which types of products can be packaged into which types of boxes. For example if this set includes all possible (i, j) pairs then all products match all boxes, but in general this need not be the case.

At the beginning of every work day, the packaging floor is empty. Upon arrival of a product and a box, the control unit of the packaging floor immediately checks if packaging is possible: This is done by observing all of the products and all of the boxes that are are in the floor and then selecting product and box pairs for packaging. Sometimes matching is not possible since there are no matching pairs, sometimes one match is possible and sometimes two.

Assignment

Consider first the following matching rule: *First Come First Serve* (FCFS), this rule implies that the product waiting most is matched with the box waiting most. Prepare an efficient simulation program which takes the parameters α_i, β_i and G and assumes that the arrivals at different times are independent of each other. The simulation program should determine: (1) Stability of the system: Does the number of products and boxes stay bounded or increase with time? (2) If the system is stable. It should also determine the proportions $r_{i,j}$ of matches of products i to boxes j. After running the simulation program on some test cases, think of other possible matching rules, implement them in the simulation program, re-run and compare the results. The project should be summarized in a written report.

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