THE SYMMETRIC LONGEST QUEUE MODEL

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Suppose we have a number of identical production lines, where at the end the finished products are packed by one server. Each production line has its own finite buffer in which finished products are stored before being handled by the server. If a production line finishes a product and the buffer is full, then the line will be blocked until space becomes available in the buffer. To prevent blocking as much as possible the server always picks a new product from the buffer containing the largest number of finished products.

If all production times are assumed to be exponential and if the production lines are assumed to have always raw materials available to work on, then the above production system may be modeled as an exponential, symmetric longest queue model. To compute the fraction of time that each production line is blocked, we derive an upper and lower bound model which both can be analyzed by using the matrix-geometric approach of Neuts. This leads to an efficient algorithm for the computation of the minimal buffer size required for meeting some target level for the fraction of time that each production line works.