Comment on "Bulk Queue Model for Computer System Analysis"

The writer believes that unique interpretation of the results in the subject paper [1] is likely only under severely modified assumptions.

The problem formulation by Chang centers on ". . . a multi-server system with c servers." In the absence of details regarding the service discipline, there is a temptation to assume that immediate service is given each new arrival if one or more of the c servers is idle. Indeed, Eqs. (2) and (3) [1, p. 370] are recognized from the literature [2, p. 378] as being compatible with such a server discipline. Difficulty arises, however, if definition (4) [1, p. 371] for transition probabilities is interpreted in that context. That is, the indicated discipline for immediate service implies that the number of busy servers, i, may not be constant during the service time for any particular item. Then, the notation $P_i(j)$, where j is the number of new arrivals during a service time x, is clearly unsatisfactory for denoting transition probabilities. However, the importance of (4) to all subsequent developments in the paper is clear from the mathematics, and deference is now accorded to (4).

A highly motivated reader might attempt to devise a hypothetical system which is oriented directly to (4) and (5) [1, p. 371]. He could begin by assuming that his system had two units: a temporary storage buffer for new arrivals and a service unit which could accept up to c items at a time from the buffer. Now the buffer could be polled at the end of every service unit action. To accommodate the first term on the right-hand side of each equation in (5), the buffer might also be polled at later times whenever it is empty at a particular polling time.

Here an indirect contrast is highlighted for multiserver vs batch-service queuing systems. If the latter is intended, mystery envelops the assumption [1, p. 370] that ". . . processing time is closer to being constant than exponentially distributed." Definition of the word 'closer' is not given in the paper except possibly via inference from the numerical example. Two Erlang-2 distributions, with parameters 0.25 and 0.20, are stipulated in that example. The first of these yields a mean service time of 8 and about a 35 percent probability for service time that is either less than half or more than twice that value. The second Erlang-2 distribution gives little more constancy of service time. More importantly, the quoted assumption has no clear purpose in the context of batch-servicing discipline. However, an approach which uses something like a buffer, as above, might lead to practical significance for the final mathematical results [1, p. 371].

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References

1. W. Chang, "Bulk Queue Model for Computer System Analysis," *IBM J. Res. Develop.* 18, 370 (1974).
2. W. Feller, *Probability Theory and Its Applications*, Vol. 1, John Wiley & Sons, Inc., New York, 1950.