DIFFUSION APPROXIMATIONS FOR MULTICLASS FEEDFORWARD QUEUEING NETWORKS WITH ABANDONMENTS UNDER FCFS SERVICE DISCIPLINES

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ABSTRACT. We consider multiclass feedforward queueing networks with abandonments under FCFS (first-come, first-served) service disciplines and prove a diffusion approximation theorem for the queue lengths and workloads in those networks under heavy traffic. The diffusion limit is the unique solution to a multidimensional reflected stochastic differential equation with a nonlinear drift term as the limit of abandonmentcount process. The desired convergence is shown by taking the following steps: first, obtaining the stochastic boundedness of (scaled) workload in use of the feedforward property of class routing; second, proving the C-tightness of abandonment-count process; third, establishing the condition of state-space collapse; fourth, showing the Ctightness of workload. In the final step we prove the uniqueness (in law) of the solution to the limit equation for workload by reducing it to the uniqueness of a semimartingale reflecting Brownian motion via the Girsanov transformation technique.

 $Key\ words\ and\ phrases.$ diffusion approximation, multiclass feed forward queueing network, customer abandonment, state-space collapse.

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