CanQueue 2009.
University of Windsor
Windsor, Ontario
August 27-28, 2009

Annual Canadian National
Queueing Theory
Workshop/Conference
CanQueue 2009. University of Windsor, Windsor, Ontario
August 27-28, 2009

Conference Chair: Dr. Myron Hlynka
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Sponsored by
1. University of Windsor Department of Mathematics and Statistics
2. University of Windsor Faculty of Science
3. Canadian Operational Research Society (National)
4. Canadian Operational Research Society (South West Ontario Branch)
5. Canadian Medical Association Wait Time Alliance

SCHEDULE

Thursday: (Cars park in Lot D; mention CanQueue to attendant for free parking)
9:45-10:15 Registration and Introduction (Room B02 Odette Building)
10:15-10:45 Jarrahi
10:45-11:15 Balcioglu
11:15-11:45 Brill
11:45 - 2:00 Lunch
2:00 - 2:30 Margolius
2:30 - 3:00 Eagen
3:00 - 3:15 Break
3:15 - 3:45 Stanford
4:00 - 4:45 Simpson (Special Guest Speaker)
4:45 - 6:45 Break
7:00 - 8:00 Supper

Friday: (Cars park in Lot D; mention CanQueue to attendant for free parking)
9:00 - 9:30 Almehdawe
9:30-10:00 Alfa
10:00-10:30 Ross/Livingston/Ballentine
10:30-10:45 Break
10:45-11:15 Down
11:15-11:45 Ibrahim
11:45- 1:45 Lunch
1:45- 2:15 Molinaro
2:15- 2:45 Jiang
2:45- 3:15 Liu

Participants and Abstracts on the following pages.
SCHEDULE (with titles)

Thursday:
9:45-10:15  Registration and Introduction (Room B02 Odette Building)
10:15-10:45 Jarrahi (Performance Modeling of a Series-Parallel Unreliable Flow Line
    with Finite Buffers)
10:45-11:15 Balcioglu (Strategies for a Centralized Single Product Multi-Class M/G/1
    Make-to-Stock Queue)
11:15-11:45 Brill (An Inventory System with Order-size Dependent Cost Rate)
11:45 - 2:00 Lunch
2:00 - 2:30 Margolius (Transient solution to the M_t/M_t/c_t queue with balking and
    reneging)
2:30 - 3:00 Eagen (Analysis of Scheduling in a Diagnostic Imaging Department)
3:00 - 3:15 Break
3:15 - 3:45 Stanford (Issues in Queues and Congestion for Health Care Professionals)
4:00 - 4:45 Simpson (Special Guest Speaker)
    A Clinician's Perspective on Wait Times
4:45 - 6:45 Break
7:00 - 8:00 Supper

Friday:
9:00- 9:30 Almehdawe (Ambulance offloads delays: A Queueing Network Perspective)
9:30-10:00 Alfa (Estimating parameters for the Gilbert-Elliot channel model)
10:00-10:30 Ross/Livingston/Ballentine (Low-Variance Retrial Times in a Multiserver
    Queueing Model)
10:30-10:45 Break
10:45-11:15 Down (Control of a single server with abandonments)
11:15-11:45 Ibrahim (Queueing Analysis of a Priority-based Claim Processing System)
11:45 - 1:45 Lunch
1:45 - 2:15 Molinaro (Ordering Two Tasks in a Queueing Model)
2:15 - 2:45 Jiang (Contruction of Reversible Markov Transition Matrices)
2:45 - 3:15 Liu (Differential Allocation of Bilingual Servers in Bilingual Call Centers)
Participants: (alphabetical) and Speaker Abstracts

1. CanQueue Speaker.
Attahiru S. Alfa
University of Manitoba
Department of Electrical & Computer Engineering
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204 474-8789
Faculty

Title: Estimating parameters for the Gilbert-Elliot channel model

Abstract: We consider a noisy communication channel which is modeled according to the Gilbert-Elliot model and then develop an approach for estimating its associated parameters. The method is based on the idea of mapping the system to a Markovian arrival process with fewer parameters and then applying the standard methods for the channel parameter estimation. This approach is based on the hidden Markov model with predetermined number of states.

2. CanQueue Speaker
Eman Almehdawe
University of Waterloo
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Student

Title: Ambulance offloads delays: A Queueing Network Perspective

Abstract: Ambulance offload delays are a concern for health care providers across Canada. Offload delays occur when an ambulance arriving at a hospital is blocked from unloading a patient until a bed is available for them in the ED. Hospital beds are also allocated to walk in patients, and the allocation can depend on the acuity (priority) of the patient. We consider a model with one ambulance provider and several hospitals in a community, and represent it by a queuing network with multiple servers and blocking. In this talk, we present some related literature which can be classified on two dimensions: Queueing networks with blocking, and non-preemptive priority queues. (joint work with E. Jewkes)
Title: Strategies for a Centralized Single Product Multi-Class M/G/1 Make-to-Stock Queue

Abstract: Make-to-stock queues are typically investigated in the M/M/1 settings. For such centralized single item systems, the Inventory Rationing (IR) policy is established as optimal and the Strict Priority (SP) policy as a practical compromise (balancing cost and ease of implementation). However, when service is general, i.e., for M/G/1 queues, the optimal policy is still unknown. In these settings, we derive the optimal cost and control for the IR and SP policies and numerically show that the latter remains a practical compromise. The common tool used in investigating the IR policy in make-to-stock queues, dynamic programming, is less practical when service is general. We, in contrast, focus on the customers' decomposition: the proportion of customers of each class to the total number of customers in the queue.
Title: An Inventory System with Order-size Dependent Cost Rate
P.H. Brill (U. Windsor), M.L. Huang (Brock U.), M. Hlynka (U. Windsor)

Abstract: We analyze an \( <s, S> \) inventory system with decay and Poisson demands. The cost of an order depends on whether it occurs due to decay into level \( s \), or to a demand causing a jump below \( s \). We derive the steady-state probability distribution of stock-on-hand, a cost function, and related quantities.

Title: Control of a single server with abandonments.

Abstract: We consider a single server with two types of arrivals, where customers may abandon while waiting. In a system with no abandonments, a c-mu rule is known to be optimal. We discuss the applicability of the c-mu rule in this setting as well as novel difficulties the analysis of such a model presents.
9. CanQueue Speaker
Brendan Eagen
Department of Industrial & Manufacturing Systems Engineering
University of Windsor
Essex Hall, B74
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Student

Title: Analysis of Scheduling in a Diagnostic Imaging Department:
By: Brendan Eagen, Richard Caron and Walid Abdul-Kader.

Abstract: We present an Agent-Based Modelling Tool (ABMT) for use in the
investigation of the impact that operational level changes have on diagnostic imaging
scheduling and patient wait times. This tool represents a novel application of agent-based
modelling in the outpatient scheduling / simulation fields. The ABMT is a decision
support tool with a user friendly graphical user interface that is capable of modelling a
wide array of outpatient scheduling scenarios. The tool was verified and validated using
data and expertise from Hotel Dieu Grace Hospital, Windsor, Ontario, Canada. The
ABMT represents a technological advancement in the modelling of multi-server, multi-
priority class customer queueing systems with deterministic service times and uneven
distribution of server up-time.

10. CanQueue Attendee
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11. CanQueue Attendee
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12. CanQueue Speaker:
Basil Ibrahim
University of Waterloo
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Student

Title: Queueing Analysis of a Priority-based Claim Processing System

Abstract: We propose a situation in which a single employee is responsible for processing incoming claims that can be classified as being one of two possible types. More specifically, we consider a priority-based system having separate buffers to store high priority and low priority incoming claims. We construct a mathematical model and perform queueing analysis to evaluate the performance of this priority-based system, which incorporates the possibility of claims being redistributed, lost, or prematurely processed. This is based on joint work with Steve Drekic (University of Waterloo).

13. CanQueue Speaker
Farshad Jarrahi
University of Windsor
Department of Industrial and Manufacturing Systems Engineering
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jarrahi@uwindsor.ca
Student

Title: Performance Modeling of a Series-Parallel Unreliable Flow Line with Finite Buffers,
by Farshad Jarrahi, Anwarul Aziz, and Walid Abdul-Kader

Abstract. An approximation method based on discrete state Markov chain is developed to estimate the production rate of a series-parallel unreliable flow line with finite buffers. The proposed method replaces a set of parallel machines at a work centre with an equivalent machine in order to obtain a traditional flow line with work centres connected in series and separated by intermediate buffers. The method also derives the failure rate, repair rate and processing rate of the equivalent machine when it operates in isolation as well as in flow line. The few published analytical methods for series-parallel systems consider only flow lines with a maximum of two work centres in series and an intermediate buffer. Moreover, they are limited in estimating performance measures of flow lines composed only of identical machines in parallel. The proposed method, however, extends the aforementioned estimations for flow lines of any length with identical and/or non identical machines in parallel. Numerical examples are presented to show the applicability of the method.
14. CanQueue Attendee
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Faculty

15. CanQueue Speaker
Qian Jiang
University of Windsor
Dept. of Mathematics and Statistics, University of Windsor,
Windsor, Ontario N9B 3P4
jiang1h@uwindsor.ca
Student
Title: Construction of Reversible Markov Transition Matrices

Abstract: We examine methods of constructing reversible Markov Chains including one small queueing model.

16. CanQueue Attendee
Walid Abdul-Kader
University of Windsor
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University of Windsor
kader@uwindsor.ca
Title: Differential Allocation of Bilingual Servers in Bilingual Call Centers
By David Stanford and Weiwei Liu
(based on work with Guy Latouche [ULB] and Xiaohui Feng)

Abstract: We present a queueing model of a call center with two unilingual agent pools as well as a bilingual agent pool. The bilingual servers are allocated based on the difference in the queue lengths of the two language groups. When the queue lengths are close to each other, we allocate in proportion to the fraction of traffic from the majority and minority language traffic streams. Once one queue length exceeds the other by pre-specified thresholds, all customer selections by bilingual agents will come from this longer queue until its length has been sufficiently reduced. Numerical examples involving call centers of size 6, 10 and 15 will be given.

Topic: Transient solution to the M_t/M_t/c_t queue with balking and reneging

Abstract: In this talk, we present an analysis of the M/M/c queue with balking and reneging. It is assumed that customers balk with a known but time-varying rate and renege according to an exponential distribution with known time-varying parameter. Arrival and service rates also vary with time with the rates known. The number of servers is also permitted to vary. This generalizes a recent paper by Al-Seedy, El-Sherbiny, El-Shehawy and Ammar and my earlier work on time-varying queues. We also examine the difficulties in extending the results to find the asymptotic periodic solution.
20. CanQueue Speaker
Samantha Molinaro
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Dept. of Mathematics and Statistics, University of Windsor,
Windsor, Ontario N9B 3P4
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Student

Title: Ordering Two Tasks in a Queueing Model

Abstract: A special customer must complete two tasks (two independent queues) in any order. One task has no wait and a deterministic service time. The other task involves joining an M/M/1 queue. The customer knows the initial queue length and the historical arrival and service rates. We study the best strategy to give the shortest completion time.

21. CanQueue Speaker
Andrew M. Ross (with Livingston and Ballentine)
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Faculty

Title: Low-Variance Retrial Times in a Multiserver Queueing Model
By: Andrew Ross, David Lubke, Andrew Livingston, Katherine Ballentine

Abstract: A retrial queue model arises often in analyzing phone systems where there is no organized queue. If all channels are busy when a customer attempts a call, the customer must try again after some length of time rather than waiting on hold. In many cases the retrial mechanism is automated, and thus has a fairly low variance in retrial times. We use deterministic retrial times in multi-server retrial queue models of moderate size (10-60 servers) under square-root staffing rules, computing performance measures via discrete-event simulation. We compare the error in predicting system performance when approximating with an exponential retrial distribution and examine a counter-intuitive pattern. We also investigate the use of extended probabilities in Markovian retrial models to reach low variances while keeping the state space size computationally tractable.
22. CanQueue Attendee  
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Faculty

23. CanQueue Special Guest Speaker  
Chris Simpson, MD FRCPC FACC  
Division of Cardiology (Department of Medicine)  
Queen's University  
Medical Director, Cardiac Program  
Kingston General Hospital / Hotel Dieu Hospital  
Kingston, Ontario, CANADA  
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**Title:** A Clinician's Perspective on Wait Times.  

**Abstract:** The work of the Wait Time Alliance (WTA) will be discussed, giving some anecdotes and insights from a clinician's point of view. There will be a discussion of where and why waiting occurs in medical services, together with comments on what is currently being done to reduce waits.
Title: Issues in Queues and Congestion for Health Care Professionals

Abstract: This talk is intended at identifying the key factors pertinent in most if not all queueing systems, and in interpreting from a health care perspective those that are of greatest pertinence. Illustrations from liver transplants and an endoscopy unit are presented. The factors we consider are occupancy/utilization, variability, pooling of resources, and priority systems. The inherent trade-off between the utilization of health care facilities and patient delay is discussed.