

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
Dept of Mathematics & Statistics
University of Windsor, Windsor, Ontario N9B 3P4
519-253-3000 (ext 3014) hlynka@uwindsor.ca

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 (Construction 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

alfa@ee.umanitoba.ca

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

200 University Avenue West,

Waterloo, Ontario, Canada N2L 3G1

ealmehda@engmail.uwaterloo.ca

+1 519 888 4567 ext. 32475

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 queueing 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)

3. CanQueue Speaker

Baris Balcioglu

Department of Mechanical and Industrial Engineering University of Toronto

5 King's College Road Toronto ON M5S 3G8

baris@mie.utoronto.ca

416 978 57 46

Faculty

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.

4. CanQueue Speaker

Katherine Ballentine (with Ross and Livingston; see Ross for title)

Eastern Michigan University

onestrangequark@hotmail.com

Joint talk with Andrew Livingston and Andrew Ross

Student

5. CanQueue Attendee

Sabrina Bernardi

Department of Mathematics and Statistics

University of Windsor

bernards@uwindsor.ca

Student

6. CanQueue Speaker
Percy Brill
U. of Windsor
brill@uwindsor.ca

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 $\langle s, S \rangle$ 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.

7. CanQueue Speaker
Douglas Down
McMaster University
Department of Computing and Software
1280 Main Street West
Hamilton, ON L8S 4L7
downd@mcmaster.ca
(905) 525-9140 x-24054
Faculty

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 - μ rule is known to be optimal. We discuss the applicability of the c - μ rule in this setting as well as novel difficulties the analysis of such a model presents.

8. CanQueue2009 Attendee:
Steve Drekić
University of Waterloo
Dept. of Statistics & Actuarial Science,
University of Waterloo, 200 University Ave. West,
Waterloo, Ontario, N2L 3G1
sdrekić@math.uwaterloo.ca
519-888-4567 x35550
Faculty

9. CanQueue Speaker

Brendan Eagen

Department of Industrial & Manufacturing Systems Engineering

University of Windsor

Essex Hall, B74

eagen2@uwindsor.ca

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

Qi-Ming He

Dalhousie University

Department of Industrial Engineering

Dalhousie University

Halifax, Nova Scotia, Canada B3J 2X4

Qi-Ming.He@dal.ca

(902) 494-6141

Faculty

11. CanQueue Attendee

Myron Hlynka

University of Windsor

Dept. of Math & Stat.

Windsor, Ontario N9B 3P4

519-253-3000 (ext 3014)

hlynka@uwindsor.ca

Faculty

12. CanQueue Speaker:
Basil Ibrahim
University of Waterloo
Dept. of Statistics & Actuarial Science,
University of Waterloo, 200 University Ave. West,
Waterloo, Ontario, N2L 3G1
basilkw@hotmail.com
519-888-4567 x33812
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 Drekić (University of Waterloo).

13. CanQueue Speaker
Farshad Jarrahi
University of Windsor
Department of Industrial and Manufacturing Systems Engineering
University of Windsor
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

Beth Jewkes

Department of Management Sciences, University of Waterloo

Address: 200 University Ave W

Waterloo, ON N2L 3G1

(519) 888 4567 ext 33279

emjewkes@engmail.uwaterloo.ca

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

Department of Industrial and Manufacturing Systems Engineering

University of Windsor

kader@uwindsor.ca

17. CanQueue Speaker

Weiwei Liu

Dept. of Statistical and Actuarial Sciences

University of Western Ontario

wliu89@uwo.ca

student

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 fract 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.

18. CanQueue Speaker

Andrew Livingston (with Ross and Ballentine; see Ross for title)

Eastern Michigan University

alivings@emich.edu

Student

19. CanQueue Speaker

Barbara Margolius

Cleveland State University

2121 Euclid Ave., Cleveland State University, Mathematics Dept. RT1515, Cleveland OH 44115-2214

b.margolius@csuohio.edu

216-687-4682 (o) 216-407-6178(c)

Faculty

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

University of Windsor

Dept. of Mathematics and Statistics, University of Windsor,

Windsor, Ontario N9B 3P4

molinar@uwindsor.ca

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)

Department of Mathematics

Eastern Michigan University

515 Pray-Harrold

Mathematics Dept.

Eastern Michigan University

Ypsilanti, MI 48197

andrew.ross@emich.edu

(734) 487-1064

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

Stanley L. "Stan" Sclove

University of Illinois at Chicago

IDS Dept (MC 294), 601 S. Morgan St., Chicago, IL 60607-7124 USA

slsclove@uic.edu

847-835-0206

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

simpsonc AT kgh.kari.net

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.

24. CanQueue Attendee
Raj Srinivasan
University of Saskatchewan
140, McLean Hall
106 Wiggins Road
Department of Math and Stats
Saskatoon, S7N 5E6
306 966 2117
raj@snoopy.usask.ca
Faculty

25 CanQueue Speaker
David Stanford
University of Western Ontario
stanford@stats.uwo.ca
Faculty

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.

26. CanQueue Attendee
Yiqiang Zhao
Carleton University
School of Mathematics and Statistics, 1125 Colonel By Dr.
Ottawa ON K1S 5B6
zhao@math.carleton.ca
613-265-8988