IIQP NEWSLETTER

Winter 2002

Institute for Improvement in Quality and Productivity

University of Waterloo

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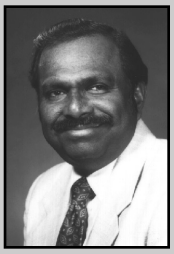
Data to Knowledge

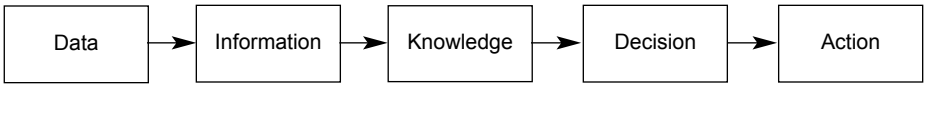
B. Abraham

Bovas is the Director of the IIQP and has been a consultant with the Institute since its inception. His main areas of interest include Quality Improvement, and the management and implementation of statistical procedures.



Bovas Abraham

Recent advances in computing, information technology and internet have made it easier to collect, store and distribute large amounts of Data in a fraction of a second. There is an illusion that collection of huge data sets create Knowledge and there exists a variety of databases (some of them are the so called Knowledge Discovery Databases) containing huge amounts of data. Do they actually create knowledge? The answer is not clear-cut. Data is not Knowledge but it can lead to Knowledge. The following diagram may help to clarify the progression from Data to Knowledge.



Data can lead to information which can in turn lead to Knowledge followed by Decision and Action. Dr. Edward Deming once said that decisions should be based on facts supported by Data. Statistics deals with acquisition of Knowledge by observation (from Data). Acquiring Knowledge about a process from Data requires critical events and perceptive observers. The perceptive observer observes data from a process and recognizes the occurrence of a special or critical event, and this leads to certain knowledge about the process.

Data are always noisy. Knowledge acquisition involves, apart from other things, the 'separation' of noise from 'signals' or patterns (if they are there). The noise can be combination of several things. For example, variation from measurement systems gets imbedded in the measurements (data) that we obtain from a process. It is important to keep this variation small to understand what is really happening in the process.

Often in quality improvement studies, repeatability and reproducibility studies are performed first to find out the contribution of measurement systems (gauges, operators, etc.) to the overall variation. Studies of gauge accuracy are also done to understand potential biases. If the gauge is biased or measurement system variation is more than what is acceptable, then efforts should be taken to improve the measurement system before the quality improvement study is performed.

The databases today contain millions of pieces of data. To acquire Knowledge from these, people use Data Mining, an array of statistical and computing tools, to obtain some 'signals' or patterns from the available data.

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Published in the Spring, Fall and Winter, the *IIQP Newsletter* is the official newsletter of the **Institute for Improvement in Quality and Productivity** at the University of Waterloo. It is available free of charge.

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Please Circulate and Recycle

Data to Knowledge

... Continued from Page 1

Although it sounds simple, it can be very complicated. Often different databases do not 'talk' to each other and hence we have to spend enormous amounts of time trying to get the data into a form useful for any statistical analysis (or transforming it into information).

Data quality is also a very serious issue especially in the context of the internet through which millions of pieces of data are transmitted in a fraction of a second. Sometimes data collection is not well documented and hence can be ad hoc, data entry mistakes can occur, and sometimes some data may be missing. Thus, some data cleaning efforts may be necessary before the data are analyzed. Sometimes we may end up with noise.

Statisticians classify data as Experimental or Observational. An experiment is a planned study in which data are obtained after deliberate process changes. An observational study is one in which a process is monitored (no deliberate changes are made) to obtain data to assess the effects of certain factors on a response. The study may also use available data (which was collected for some other purpose) or may involve active collection of data. Most data mining efforts are on available data.

In the context of quality improvement, Dr. Deming indicated that there are 3 ways of getting better 'numbers' or data and hence conclusions drawn are often tentative.

1. Improve the system to get improved numbers: Make fundamental changes that improve quality, prevent errors, and reduce waste.

2. Distort the system: Get the (demanded) better numbers at the expense of other results. For example, lower the inventory by keeping (or shipping) the parts on a truck and keep it moving around for the time being.

3. Distort the numbers (data): Use creative accounting to show whatever you'd like to show.

If the data are to be used for making sound decisions, then we need to make sure that the data are obtained in a sensible way. Governments and industries have been collecting huge amounts of data each year, requiring large personnel and other resources. The collection costs runs into 100's of millions of dollars each year in direct cost. The cost of poor data can be enormous as well. Decisions originating from poor data and analysis can result in writing and implementing inadequate policies, regulations, laws, etc. The resulting costs are 'unknowable' but extremely huge and serious.

In non-manufacturing situations sometimes the cost of poor data can be very large as well. For instance, interlaboratory variation can create incorrect measurements on cholesterol levels. This author is aware of a study (a few years ago) in which the same sample of blood was sent to a number of laboratories in the US. The measured cholesterol levels ranged from 180-245. With this range of variation a person with a level of 180 (no risk category) can be classified in the risk category and be subjected to unnecessary medications and psychological difficulties. Also a person in the risk category can be misclassified into the no risk category with obvious serious consequences. Once, Dr. Stuart Hunter, former president of the American Statistical Association, mentioned, "Data of poor quality are a pollutant to clear thinking and rational decision making".

In summary, the quality of decisions that we make depends on the quality of data on which the decisions are taken and, hence data quality is of paramount importance for knowledge creation. ◆

Book Review

B. Abraham

Six Sigma: The Breakthrough Management Strategy Revolutionizing the World's Top Corporations by Mikel Harry Ph.D., and Richard Schroeder Published by Doubleday, a division of Random House Inc., New York

“Six Sigma is the most important initiative GE has ever undertaken… it is part of the genetic code of our future leadership." This is a quote from the back of the book attributed to Jack Welch, CEO of GE. This is a very strong statement and there are similar quotes from other leaders as well.

This is a 300 page non-technical hard cover book costing $44.95 (CDN) written for business or a popular audience. It has 15 chapters as indicated below

1. Why Six Sigma
2. The Yellow Brick Road
3. Being Better Is Cheaper - One Company's Experience: General Electric 2000
4. Benchmarking: Discovering Who Is Really Best
5. Changing What Companies Measure: A Six Sigma Credo
6. Unmasking The Hidden Factory One Company's Experience: Polaroid Flashes Back
7. The Breakthrough Strategy
8. Measuring Performance on the Sigma Scale - One Company's Experience: How General Electric Used Six Sigma to Design a Multimillion-Dollar Product
9. Implementation and Deployment
10. The Six Sigma Players: Champions, Master Black Belts, Black Belts, and Green Belts
11. Six Sigma Black Belts - One Company's Experience: AlliedSignal's Journey to Six Sigma
12. Six Sigma and the Service Industry
13. Project Selection Guidelines
14. The Psychology of Six Sigma
15. Preparing an Organization for Six Sigma

Chapter 1 gives a short history of Six Sigma and makes a case for its implementation by indicating that 'Six Sigma is about making money'. Chapter 2 gives an overview of the eight-step Breakthrough Strategy: Recognize, Define, Measure, Analyze, Improve, Control, Standardize, and Integrate. This Strategy is detailed in Chapter 7. Chapter 2 also indicates that Six Sigma is a 'disciplined method of using extremely rigorous data-gathering and statistical analysis to pinpoint sources of errors and ways of eliminating them'. 'We believe that statistical knowledge is to the information and technical age what fossil fuel was to the industrial age. In fact, the future of industry depends on an understanding of Statistics'.

Chapter 3 discusses the Cost of Poor Quality (CPQ) and outlines GE's experience with Six Sigma. CPQ is also indicated in Chapter 7 where Polaroid's experience is outlined as well. The role of Six Sigma in Benchmarking is considered in Chapter 4 while its use as a metric for measurement is in Chapter 5.

Measurement is the key:

'”We don't know what we don't know
We can't do what we don't know
We don't know until we measure
We don't measure what we don't value
We don't value what we don't measure”

Six Sigma is linked to short-term and long-term capability in Chapter 8 and the idea of the shift-factor in Six Sigma is discussed here as well. They also outline how GE used Six Sigma to design a multimillion-dollar product.

Chapters 9, 10 and 11 detail various aspects of implementing Six Sigma throughout an organization describing the needed organizational structure, and the various players such as Executive Management, Champions, Master Black Belts, Black Belts, and Green Belts. Since the bulk of the implementing strategy rests on Black Belts, their importance, selection, training, and roles are described in Chapter 11 together with AlliedSignal's journey to Six Sigma.

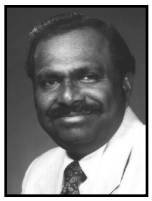
Chapter 12 indicates that Six Sigma can play a role in service industry as well, Chapter 13 gives some guidelines for selecting Six Sigma projects, and Chapter 14 talks about rewarding the people. The final chapter (15) talks about preparing an organization for Six Sigma.

The book is written in an easy style and is interesting to read. The quotes from the business leaders are quite strong. Often business people have a way with words. They probably will say the same things about many other programs which may come their way. The experiences and dollar gains outlined in the book are very impressive. The difficulty is to claim that all that improvement and the monetary gain are due to Six Sigma. For example, GE embarked on Six Sigma in 1996 but they had other improvement programs in the 1980's. Since the book is written for business and a popular audience, anecdotal evidence may be enough. It would have been interesting to include the status of Six Sigma in Motorola where it all began.

The book stresses the importance of Statistical Thinking and Statistical tools to implement Six Sigma. In the summary at the end of the book the authors submit that the success of Six Sigma depends on the factors: 'Does your company 's leadership understand and are they completely behind implementing Six Sigma? Is your company open and ready to change? Is your company hungry to learn? Is your company anxious to move quickly on a proven idea? Is your company willing to commit resources personnel and money to implement this initiative? Is your organization and its people ready and able to re-create its values so that there are no roadblocks to achieving the vision of Six Sigma?' This author could not agree more. The success of any program such as Six Sigma depends on the commitment of the top management and the discipline of the people to go through a systematic improvement process. I enjoyed reading the book. ◆

Upcoming Courses

Meet some of our Course Instructors ....



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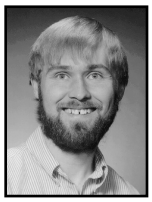
Director, IIQP

G. Dennis Beecroft
Managing Director, IIQP



Hugh Chipman
Consultant, IIQP

Jock MacKay
Consultant, IIQP

Stefan Steiner
Consultant, IIQP

Gary Waller
Associate Provost, Academic and Student Affairs, UW

Cost of Quality for Continuous Improvement

TWO DAY COURSE

Course Description

Cost of Quality (COQ) is an excellent continuous improvement (CI) management tool. COQ can be used effectively to identify, prioritize and then track CI projects by breaking down quality costs into four standard categories: prevention, appraisal, internal failure and external failure.

You Will Learn

- To Categorize Elements of COQ
- Select and Track Projects
- Choose Vendors and Price Products Using COQ
- Use Cost of Quality for CI in QS-9000 and ISO 9000

Who Should Attend

- Financial Officers
- Quality Managers and Professionals
- Continuous Improvement Team Leaders

Course Dates

February 7-8, 2002
June 5-6, 2002

Cost

$790 (+GST)

Cost Includes: tuition, course notes, handouts, lunches, coffee and refreshments.

Advanced Data Mining

ONE DAY COURSE

Course Description

More and more companies have enormous databases which may contain undiscovered but useful information. Data Mining is the search for this information using statistical models and computational techniques. This one day course will illustrate the state of the art, using real data from direct marketing, drug discovery and industrial control problems.

You Will Learn

- What is Data Mining?
- Methods for Preprocessing Data
- Graphical Exploration of Data
- Classification and Regression Techniques
- Clustering

Applications in the Course Include

- Direct Marketing
- Drug Discovery
- Process Monitoring with High Dimensional, High-Volume Data

Course Dates

February 5, 2002
March 12, 2002

Cost

$395 (+GST)

Cost Includes: tuition, course notes, handouts, lunch, coffee and refreshments.

Design of Experiments

TWO DAY COURSE

Course Description

A designed experiment is a special type of process study that involves changing one or more process characteristics to investigate their effects.

Design of Experiments (DOE) is one of the continuous improvement tools in Six Sigma and ISO 9001:2000. This two day course will teach you how to effectively use this key methodology to improve quality and reduce costs.

This course will provide you with the right tools to understand, plan and execute an experiment. You will also gain the experience in deciding if experimentation is a good approach to your particular problem(s).

You Will Learn

- What is an Experiment?
- Experiments vs. Other Data Based Approaches
- Complete Factorial Experiments - looking at several factors simultaneously
- Fractional Factorial Designs - efficient ways to look at many factors
- Taguchi's Robust Designs to Reduce Variation
- Implementation - Planning and Executing Experiments

Course Dates

March 7-8, 2002
November 7-8, 2002

Cost

$790 (+GST)

Cost Includes: tuition, course notes, handouts, lunches, coffee and refreshments.

NEW

Effective Problem Solving

TWO DAY COURSE

Course Description

Effective Problem Solving involves a disciplined methodology and the use of appropriate tools. This workshop teaches a 5-step problem solving model - define problem, containment, determine root cause, implement solution and verification of solution, and tools to be used at the various steps within the problem solving process.

You Will Learn

- How to Correctly Define the Problem
- Understand Work as a Process
- Identify Different Types of Problems
- Define Processes Using Process Maps
- Learn the 5-Step Problem Solving Model
- Practice the Use of Problem Solving Tools

Who Should Attend

- Quality Managers and Professionals
- Quality Improvement Team Members

Course Dates

February 14-15, 2002
June 12-13, 2002

Cost

$790 (+GST)

Cost Includes: tuition, course notes, handouts, lunches, coffee and refreshments.

Training Effectiveness

ONE DAY COURSE

Course Description

Training Effectivness is a requirement for ISO 9001 Quality System Requirements under Element Training. This introductory workshop is based on the Kirkpatrick Model.

You Will Learn

- Options and Recommendations for Developing Evaluations
- Procedures for Measuring Effectiveness
- Roadblocks to Effective Evaluation
- How to Evaluate at the Four Levels (Reaction, Learning, Behaviour and Results) and Pros and Cons of Different Approaches

Who Should Attend

- Human Resources Personnel
- Training Professionals
- Management Leaders
- Quality Professionals

Course Dates

March 21, 2002
June 20, 2002

Cost

$395 (+GST)

Cost Includes: tuition, course notes, handouts, lunch, coffee and refreshments.

NEW

Understanding Six Sigma

ONE DAY COURSE

Course Description

Six Sigma is an improvement system which is seen as a business strategy to gain the knowledge needed to obtain better quality products and services faster and cheaper. More and more companies are trying to implement this system. This one day course is mainly oriented to people from small to medium companies who are contemplating about undertaking a Six Sigma initiative. This course will provide an overview of the Six Sigma system.

You Will Learn

- What is Six Sigma?
- DMAIC Process
- Statistical Thinking
- Variation Reduction
- Six Sigma and Process Capability
- Statistical Tools in Six Sigma
- Training in Six Sigma

Course Dates

April 5, 2002
November 14, 2002

Cost

$395 (+GST)

Cost Includes: tuition, course notes, handouts, lunch, coffee and refreshments.

Statistical Process Control

ONLINE COURSE

Course Description

This new course is equivalent to a 2 day (14 hours) short course on Statistical Process Control (SPC). This online course is developed for people involved in process control and improvement activities. It will provide an understanding of the basic concepts of Variation, Stability, Capability, etc.

Course Contents

- Understanding Variation
- Charts for X-Bar and R
- Charts for Individuals
- Sampling for Charts
- Process Capability
- Charts for Attribute Data

For More Details Visit:

http://www.iiqp.uwaterloo.ca/SPC

Registration Information

Use the online form to register. Once the form and payment is received a user name and password is issued via e-mail.

Course Available Online

January 2 to April 30, 2002

Cost

$295 (+GST)

NEW

The Best of Statistical Engineering

TWO DAY COURSE

Course Description

Statistical Engineering is a combination of statistical strategies and tools carefully selected to efficiently solve chronic problems in high volume manufacturing. Statistical Engineering attempts to exploit observational data from your exisiting process to “home in” on the root cause of problems.

This two day course covers the guiding strategies and tools you need to effectively apply this exciting methodology to improve quality and reduce costs. This course is a requirement for our new Statistical Engineering certification program, and is also a good compliment to the Design of Experiments two day course.

You Will Learn

- Guiding Principles of Statistical Engineering
- Structured Problem Solving Strategy - diagnostic and remedial journeys
- Progressive Search and Families of Variation
- Clue Generation Methods - using observational data to efficiently guide improvement efforts

Course Dates

January 24-25, 2002
April 11-12, 2002

Cost

$790 (+GST)

Cost Includes: tuition, course notes, handouts, lunches, coffee and refreshments.

Third Edition

ISO 9001:2000

An Updating Overview

ONE DAY COURSE

Course Description

This course is designed for organizations who are already registered to ISO 9000 and need to know more information on the updated edition.

The Third Edition ISO 9001:2000 has made several changes creating a more user friendly standard. It has simplified its language, reduced the required documentation, and made several changes based on customer and user feedback. This edition will be easier to implement, use and upgrade from the previous editions.

In this updating course, find out about the changes and how it impacts your organization and your registration status.

You Will Learn

- Background on 2000 Edition
- Overview of Changes
- Impact on Current Quality System
- Transition Guidance
- Review of Critical Changes
- How to Implement Changes
- Changes to Auditing

Course Dates

March 14, 2002
November 12, 2002

Cost

$395 (+GST)

Cost Includes: tuition, course notes, handouts, lunch, coffee and refreshments.

Statistical Process Control

TWO DAY COURSE

Course Description

Statistical Process Control deals with data based decisions about actions affecting a process. This two day course is developed for people working in industry who are involved in process control and improvement activities. This course will provide an understanding of the basic concepts of Variation, Stability, Charting and Process Capability.

Course Contents

- Understanding Variation
- Charts for X Bar and R
- Charts for Individuals
- Sampling for Charts
- Process Capability
- Charts for Attribute Data

Course Dates

April 25-26, 2002
November 28-29, 2002

Cost

$790 (+GST)

Cost Includes: tuition, course notes, handouts, lunches, coffee and refreshments.

How Do I Register?

REGISTRATION INFO

You may register by returning the following form or contacting the Institute at the address below.

Institute for Improvement in Quality and Productivity
200 University Ave. W.
University of Waterloo
Waterloo, Ontario N2L 3G1

Tel: (519) 888-4593
Fax: (519) 746-5524
E-Mail: iiqp@math.uwaterloo.ca

More Information

- All IIQP courses can be tailored to suit specific needs or applications and presented within your company. Such courses are often developed by modifying or combining existing courses, depending on the request.
- Instructors are University of Waterloo faculty and IIQP staff who are professionals with extensive industrial training and consulting experience.
- Please add GST to all course fees (GST#: R119 2606 85)

Name: _____

Position/Company: _____

Address: _____

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Postal Code: Zip: _____

Tel: _____

Fax: _____

E-Mail: _____

Please Specifiy Course(s) and Date(s):

_____

_____

☐ Bill Later ☐ Cheque / Money Order Enclosed

Recent Presentations

Dimensionality Reduction Approach to Multivariate Prediction

International Symposium on PLS and Related Methods
Capri, Italy October 2001 B. Abraham

Effective Monitoring of Processes with Parts Per Million Defective - A Hard Problem!

7th ISQC Workshop, University of Waterloo
Waterloo, Ontario, Canada September 2001 S. Steiner

Improving Quality Management Systems Using Quality Costs

55th Annual Quality Congress, American Society for Quality
Charlotte, North Carolina, USA May 2001 G.D. Beecroft

Managing Multiple Models

Joint Statistical Meetings
Atlanta, Georgia, USA August 2001 H. Chipman

Mining Nuggets from High Throughput Screening Data

National Institute of Statistical Sciences
North Carolina, USA May 2001 W. Welch

Monitoring Production with Immense Datasets

University of Waterloo
Waterloo, Ontario, Canada May 2001 H. Chipman

Some Practical Problems in Event History Analysis for Clinical Trials

Statistics 2001 Canada
Montreal, Quebec, Canada July 2001 J. Lawless

Statistical Methods For Deterministic Biomathematical Models

53rd Session of the International Statistical Institute
Seoul, Korea August 2001 W. Welch

Survival Analysis and Sample Surveys

Conference in Honour of Muni Srivastava
Toronto, Ontario, Canada July 2001 J. Lawless

The Use of Eigenvalues in Priority Queues

INFORMS Applied Probability Conference
New York City, New York, USA July 2001 S. Drekic

The Use of Symbolic Computation to Derive Moments

INFORMS Applied Probability Conference
New York City, New York, USA July 2001 S. Drekic

Transient Analysis of the $M^X/M/\infty$

Statistics 2001 Canada, Concordia University
Montreal, Quebec, Canada July 2001 S. Drekic

Using Symbolic Computation to Derive Moments of the Time to Ruin

CORS National Conference
Quebec City, Quebec, Canada May 2001 S. Drekic

Why SPC Often Fails

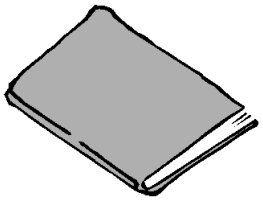
2001 Quality and Productivity Research Conference
Austin, Texas, USA May 2001 S. Steiner

thank you corporate sponsors

The Institute gratefully acknowledges the contributions of the following corporate members:
Continuous Colour Coat Limited, General Motors of Canada, Nortel Networks, Research in Motion (RIM), and Wescast Industries.

Their continued support throughout the year has been invaluable. Their support contributes to the success of this newsletter.
Thank you!

2001 IIQP Research Report Series



RR-01-09
Testing Linear Hypotheses with a Generalized Multivariate Modified Bessel Error Variable
L. Thabane & S. Drekic

RR-01-08 (NT)
Cost of Quality, Quality Planning and the Bottom Line
G. D. Beecroft

RR-01-07
Scale Counting
S. Steiner & J. MacKay

RR-01-06
Uniform Coverage Designs for Molecule Selection
R.L.H. Lam, W. Welch & S. Young

RR-01-05
Dimension Reduction Methods Used in Industry
G. Merola & B. Abraham

RR-01-04
Time Series in Industry
G. Merola & B. Abraham

RR-01-03
Multivariate Prediction with Latent Variables
B. Abraham & G. Merola

RR-01-02
Differencing a Time Series and Modifications to the Variogram
B. Abraham & N. Balakrishna

RR-01-01
Interpretable Dimension Reduction
H. Chipman & H. Gu

These and all other IIQP Research Reports and/or Abstracts since 1988 are available free of charge. Visit our website for a complete listing of all IIQP Research Reports.

www.iiqp.uwaterloo.ca/rrs.html

Driving Bottom Line Improvement with Quality Tools

IIQP Seminar - April 23-24, 2002

IIQP, together with its corporate partners, is planning a unique two day seminar. The seminar is aimed at helping small and medium sized organizations eliminate waste, reduce costs and improve the bottom line. It will show how simple problem solving and process improvement tools can help an organization improve its financial position. The goal of the seminar is for participants to take home something they can immediately put into practice. The seminar includes business case studies, from some of our corporate partners including General Motors, Research in Motion, and Wescast Industries, demonstrating the impact of these methodologies and tools.

The seminar includes topics such as defining problems, measurement issues, variation reduction, controlling sources of variation, process robustness, and implementation. It will show that a disciplined method of using data collection and statistical analysis can pinpoint sources of variation and ways of eliminating them.

The seminar leaders are IIQP faculty and staff who are professionals with strong conceptual knowledge and substantial business experience. Case study presenters are senior industry executives who will share their experiences implementing quality improvement in their organizations. Please see the back page of this newsletter for more information.

2 Day Seminar
Corporate Sponsored

April 23-24, 2002
Davis Centre, Room 1302
University of Waterloo

driving bottom line

improvement with quality tools

The IIQP and several of its corporate members have developed a unique program to assist small and medium sized organizations meet the challenging task of reducing costs, eliminating waste and improving bottom line performance. The pressure on all organizations to do this successfully is increasing daily in the current economy.

Seminar topics include:

- Defining problems, understanding problem complexity and appropriate problem solving approaches
- Understanding variation in processes and using appropriate evaluation tools
- Learning strategies and tools to determine root cause
- Understanding and determining effective implementation strategies
- Learning how management systems evolved and how they are best integrated for maximum impact
- Corporate case studies to show the application of tools and strategies to produce tangible results.

The goal of the seminar is for the participant to take home something they can immediately put into practice.

Corporate Members: $500 Non-Corporate Members: $550

For more information or to register contact the IIQP at:
Tel: (519) 888-4593 ◆ Fax: (519) 746-5524 ◆ E-Mail: iiqp@math.uwaterloo.ca
Enrolment is Limited

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