Queen's UNIVERSITY

Senate Committee on Academic Development
Report to Senate - Meeting of November 27, 2012

Proposal to introduce a Master of Management Analytics

Introduction

The proposal to introduce a Master of Management Analytics in the Queen's School of Business (QSB) and the School of Graduate Studies (SGS) was reviewed by the Senate Committee on Academic Development (SCAD) at its meeting of November 7, 2012. S. den Otter, (Associate Dean, SGS), T. Shearer, (Associate Dean, QSB), Y. Levin (Professor of Management Science and Operations Management QSB) and E. LeBlanc (Director, Accreditations and Special Projects QSB) attended the SCAD meeting to speak to the proposal and to answer questions from members of SCAD. Members of SCAD were also provided with background documentation provided by the QSB and the SGS including the reports from two External Reviewers. The copy of the proposal attached to this report has been revised to take into account the External Reviewers and SCAD's recommendations/comments.

Analysis and Discussion

The following highlights are noted:

- The proposed MMA will be a ten-month program with a delivery model similar to that used already in the Master of Finance Program offered by the QSB. The Program is comprised of twelve core courses with no optional or elective courses;
- Classes will be held in the teaching facilities located in downtown Toronto on evenings and alternate weekends. In addition, there will be two 1-week residential sessions held at the Donald Gordon Centre in Kingston and a third residential session held in Toronto;
- Market research has identified potential students being drawn from a combination of working professionals and recent graduates from business, engineering, mathematics and computer science programs;
- The Program is structured to meet the needs of a growing corporate/industrial shortage of persons with analytic skills. Several North American universities offer research-focused graduate degree programs in analytics but the Queen's MMA proposal is distinguished by its orientation towards professional practitioners;
- All applicants will be assisted by an academic admissions advisor who will help potential students determine if they have the necessary background and skills to successfully complete the MMA Program. Applicants that are short-listed for the Program will then be interviewed by the Program Director. Based on the QSB track-record for similar professional programs, it is anticipated that the attrition rate will be very low;

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- There will be provisions in place to assist students who may experience an unavoidable interruption in their progress to complete their degree in a timely fashion;
- The projected number of international students was based on statistics from other professional programs offered by the QSB. It was confirmed that if no international students are admitted, the program will still be financially sustainable without the extra revenue from the higher international tuition fees;
- The projected budget was developed in a conservative manner;
- Two peer-review reports, conducted by leading North American experts, were very favourable and supportive. The Reviewers suggested minor revisions for improvements of the proposal. These suggestions, together with some suggestions from SCAD itself, have been incorporated in the final proposal which is attached.

Motion

that Senate approve the establishment of a Master of Management Analytics in Queen's School of Business and the School of Graduate Studies, to commence June 2013 pending approval by the COU Quality Council.

Respectfully submitted,

Susan P. C. Cole, PhD, FRSC, FCAHS
Chair, Senate Committee on Academic Development

Committee Members:

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S. Cole, Deputy Provost (Chair)
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P. Oosthuizen, Academic Colleague

NEW GRADUATE PROGRAM PROPOSAL

Submission Form

Part A – General Summary

Name of Proposed Program:	Master of Management Analytics
Unit(s):	Queen's School of Business
Proposed Start Date:	June 2013

Contact Information (1)		Contact Information (2)	
Name:	Dr. Yuri Levin	Name:	Eric LeBlanc
Title:	Professor of Management Science and Operations Management	Title:	Director, Accreditation & Special Projects, Office of the Dean
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Executive Summary (1 page maximum suggested – Minimum font size 11 pp)

Briefly summarize the rationale for introducing this new program and how it fits with the academic goals of the Faculty/School and University. Briefly describe: the educational goals and learning outcomes; internal or external collaboration required to deliver this program; how the relevant stakeholders (e.g. faculty, staff, students) were consulted in preparing the proposal; and additional resources required to deliver this program.

Modern business and non-profit organizations are under increasing pressure to harness the extraordinary volumes of data that are now available to them through advances in information technology. This has stimulated rapid growth in a field of practice called 'Business Analytics', or 'Analytics' – a technically complex area spanning operations research, statistics, management information systems, financial analysis, marketing, and other cognate areas. The central challenge is to extract and correctly utilize information from very large data sources that may be structured, like corporate data bases, or unstructured, like the world-wide web. Such information is essential to understand markets and clients, to predict changes in those markets, and to assist evidence-based decision-making and achieve efficient and effective utilization of resources. Related fields of practice are called Business Intelligence, Data-mining, and Big Data.

There is a large and growing shortage of persons with the blend of information technology expertise, mathematical and statistical modeling skill, and understanding of management issues to deliver effective analytics to organizations. For example, the consultancy McKinsey & Company recently estimated that, in the U.S. alone, the demand for persons with deep analytical training "…could exceed the supply being produced on current trends by 140,000 to 190,000 positions…"

Queen's School of Business (QSB) proposes launching a *Master of Management Analytics* program that will meet the rapidly growing need for analysts who understand the technical and mathematical challenges of analytics as well as the management contexts in which they arise. Such a program will give students with strong quantitative abilities the skills that they need to develop, direct, and deliver projects in analytics that add value to businesses or other organizations. It will be more focused in the mathematics of analytics than current general MBA programs and more broadly based in the "business of analytics" than mathematics or engineering programs. The program will target students with significant prior mathematical training and provide thorough coverage of the mathematical and statistical theories and methods that underlie modern analytics, while maintaining a practitioner focus.

We propose a ten-month program utilizing the same delivery model as our very successful Master of Finance Program. Classes will be held at the new QSB teaching facility in downtown Toronto on evenings and alternate weekends, with two - one week residential sessions held on main Queen's campus, at the Donald Gordon Centre and Goodes Hall. This proven method of delivery allows for students to work full time, while participating in the Master of Management Analytics Program.

The program will be structured around three themes: descriptive analytics, predictive analytics, and prescriptive analytics, with the essential skills of understanding business issues and communicating with coworkers woven throughout. To develop graduates abilities to work in teams, we plan team-building exercises and communication workshops. We will introduce students to commercial-grade software packages for database management, statistical analysis, and optimization as well as other modern analytical packages used regularly by professionals. We will expect them to use these resources and explore different lines of attack to real-world problems. Students will be provided with significant opportunities to interact with mentors from the analytics community, both formally and informally.

The School has the teaching resources to offer such a program, with expertise in the areas of Management Science, Management of Information Systems, Finance, and Team Management. The facility in downtown Toronto provides excellent teaching space for such a program and is ideally located, as Toronto is the major target market for both students and employers. There are very few programs of this type in North America currently, but there is rapid growth. The addition of such an offering to the portfolio in the School supports the strategy of innovation and diversification of programs both within the School and the University. There is no external academic collaboration required to offer such a program.

Research for the development of the Program involved surveys and interviews with analytics practitioners in industry, current students, alumni, corporate recruiters, QSB faculty, QSB Advisory Board and the QSB Global Council. Companies operating in this area provided information on the requirements and design and for such a program from a corporate perspective. Current students and alumni of QSB as well as Engineering, Mathematics and Computer Science Programs were polled via a survey sent to them by email. Over 7,000 students and alumni were sent the survey. The comments from all stakeholders were taken into consideration when designing the Program. QSB Faculty were consulted individually in conversations as well as in more formal settings a including a faculty forum where the program was presented and the central topic of debate. Comments and suggestions were then incorporated and presented to faculty in two QSB Faculty Boards where faculty unanimously approved the creation and design of the Program. This provided numerous opportunities for faculty to have input in the process.

To summarize, our learning goals for this program include:

Descriptive Analytics: Graduates will be able to develop and use advanced database and search techniques to extract useful data from very large data sources and apply modern methods of data summarization and visualization to enhance understanding of organizational environments, including the economy, internal organizational performance, competitive positioning, and the structure and behaviours of markets or client groups.

Predictive Analytics: Graduates will be able to apply mathematical modeling and forecasting techniques to prepare predictions of changes in organizational environments.

Prescriptive Analytics: Graduates will be able to develop mathematical and computer models that can assist management decisions in areas such as risk management, pricing and promotion of products and services, logistics, and physical and human resource capacity allocation.

Management: Graduates will understand that advanced information technology, statistics, and mathematical modeling cannot, in isolation, solve management problems. It is the integration of these methods in an organizational context that leads to successful implementations. Graduates will be aware of the boundaries between problems that are amenable to analytical solutions and those that are not, and they will recognize the importance of nontechnical skills. They will learn to consider the ethical aspects of all undertakings, understand the challenges and advantages of working in teams, develop communication skills, and learn how to motivate and direct the activities of others.

Part B – Evaluation Criteria

1. Introduction

1.1 Describe how the Program is consistent with the University's mission and values as well as the academic goals of the Faculty(ies) and Unit(s).

The vision of Queen's School of Business is "to be one of the world's most innovative and influential business schools." QSB has a long and successful history of developing innovative, high quality programs that target a specific need in the business world. Examples of this strategy include: the first one-year, privatized MBA program in Canada; the country's first Executive MBA program delivered by live videoconference; and the first MBA program in the world targeted at students with a business undergraduate degree. The proposed Master of Management Analytics is consistent with this strategy of developing niche programs targeted at a well-defined audience. The program is aligned with Queen's high standards for quality in program design and content, delivered by faculty members with excellence in both teaching and research. The Master of Management Analytics is the third program in the School's "Master of Management" portfolio of professional graduate programs, which launched in 2007 with the Master of International Business, followed in 2010 by the Master of Finance. The objective of the programs in this portfolio is to offer specialized masters programs to recent undergraduates who want a career in a specialized area of business.

1.2 List the Objectives of the Program (or Programs) and specify the anticipated learning outcomes and career paths [Refer to Graduate Degree Learning Outcomes GDLE, page 34 of QUQAPs]

1. *Depth and breadth of knowledge*: Graduates of this program will understand the mathematical and statistical principles that underlie Management Analytics, understand modern methods for search and retrieval of data, and possess practical experience with developing and applying analytical models to real world problems. They will also understand the organizational contexts in which analytics may be effective.

   Indicators of Achievement: 1) demonstrated competence in identifying correct lines of attack to problems of business analytics; 2) expertise in modern algorithms, implementation techniques, and computer packages used in the practice of analytics; 3) expertise in business practices related to analytics.

2. *Research and Scholarship*: This is a practice-oriented program; however, graduates should have the ability to create and implement novel approaches to Management Analytics and adjust these approaches in the light of unforeseen problems. They should have the ability to make informed judgments on complex issues regarding methodological design, data analysis, and findings. They should also have the ability to research company and economic data in the preparation of case analyses, and will be well versed in methods of empirical research; for example, in the proposal of hypothetical models and rigorous testing of those models with data.

   Indicators of Achievement: 1) demonstrated ability to develop novel approaches to analytical problems; 2) knowledge of sources of data and methods of searching, extracting, summarizing and testing data from them.

3. *Level of application of knowledge*: Graduates will have the skills to develop, direct, and deliver projects in analytics that add value to businesses or other organizations.

   Indicators of Achievement: successful completion of course or program projects that originate in real world business problems.

4. *Level of communication skills*: The program will foster the ability to communicate complex ideas, issues and conclusions clearly and effectively to both technical and non-technical audiences.

   Indicators of Achievement: 1) strong writing samples and oral presentations in course work; 2) clear logic in all writing, in-class comments, discussions with colleagues, presentations, and networking, and 3) successful collaboration in project teams.

5. *Professional capacity/autonomy*: The program will develop the traits of personal responsibility and initiative necessary for business environments, the ability to work alone or as part of a team, the intellectual independence to be professionally engaged and current; and the ethical judgment necessary for responsible conduct.

Indicators of Achievement: successful completion of professional certification exams and team projects in a diverse team environment.

6. *Awareness of limits of knowledge*: Graduates will be aware of the organizational contexts in which analytical methods may be effective. They will understand the assumptions underlying analytical models, appreciate the limitations of their ideas and existing analytic approaches; and recognize the complexity of knowledge and of the potential contributions of other interpretations and methods.

   Indicators of Achievement: 1) ability to contribute to discussions on topics related to analytics; 2) ability to integrate one's own work with other activities in a diverse team environment; 3) ability to explain analytics to others.

Graduates of this program will possess knowledge and skills that are in high and increasing demand. All of the organizations that we interviewed indicated that that they anticipate increased hiring in this area. Graduates without previous work experience will have excellent potential for first-time employment as analysts in consulting and private and public sector industries. Graduates with previous work experience will be better able to move into analytical leadership positions in their current organizations or move to other organizations.

1.3 Explain how the objectives will be achieved (e.g. course work, teaching and research seminars, independent research, laboratory and technical training, internships, practica, major research papers, and thesis)

Rigorous coursework requiring completion of assignments including case studies and problem sets, and, where appropriate, examinations. Other objectives will be accomplished through team-based learning and projects, and individual and team project presentations.

1.4 Identify and provide descriptions for any Fields (academic plan) associated with the new Program(s). [degree programs only]

N/A

1.5 Address the appropriateness of the proposed nomenclature (e.g., MA, MSc, MEng). [degree programs only].

The proposed name, Master of Management Analytics – MMA – is consistent with other programs offered under the umbrella of the QSB Master of Management portfolio. The Program is professional in nature, not focused on research, hence MSc is not appropriate. Given that the program is focused in one specific area of business and not general in nature, it is not related at all to an MBA program. It is similar in structure to the Master of Finance (MFin) and Master of International Business (MIB) that are currently offered by QSB in the Master of Management Programs portfolio. Therefore, Master of Management Analytics (MMA) is the appropriate title for this new program.

2. Program Regulations

2.1 ***Admission Standards*** *- Provide the Program's admission standards, including degree, diploma or certificate and course requirements and any other specific standards with reference to the learning outcomes and expectations of the Program. Provide the rationale for standards that are in addition to those set by the School of Graduate Studies. If applicable, indicate policies/procedures to encourage applications from qualified under-represented groups (e.g. Aboriginal people, visible minorities or persons with disabilities).*

To be considered for admission an applicant must hold a minimum of a bachelor's degree from a recognized university or equivalent, with a minimum standing consistent with Queen's regulations for graduate admission. Successful applicants must also have good English language communication skills as demonstrated by standardized language tests and in an admissions interview. The previous degree can be in any area of study but a successful applicant must have training and demonstrated ability in mathematics and statistics. Such training can be part of their previous degree(s) or in addition to it, but should include reasonable coverage of differential and integral calculus, linear algebra, and probability and statistics, including multiple regression analysis. Applications will be welcomed from qualified members of under-represented groups.

As is the case with the other professional programs within the School, each applicant will be assigned an application advisor. The advisor assists the student with the application process and evaluates all documentation submitted. Advisors are extremely familiar with the requirements of the program and are able to counsel applicants as to their suitability for the program. In addition to this, advisors brief the Academic Director on each applicant file prior to their interview with the applicant. This two step process of primary

assessment done by an application advisor and interview with the Academic Director has proven to be a very effective manner to ensure successful applicants are well suited for the program.

While work experience is not a strict requirement for admission to the Program, it is preferred. This will allow a very talented applicant to be admitted directly from a relevant undergraduate program. However, given our experience with current professional masters programs, this number tends to be a very small percentage of the class.

2.2 ***Language Requirements*** *- If applicable, indicate any language requirements and provide rationale for standards that exceed the minimum set by the School of Graduate Studies. Information about SGS' English language requirements are available at: http://www.queensu.ca/sgs/forstudents/InternationalStudents/admissionreqs.html*

There are no language requirements for this program that exceed those set by the School of Graduate Studies.

3. Program Structure and Requirements

Describe the Program under the following headings (where applicable)

3.1 ***General Program Requirements*** *– Describe the program duration and rationale (max 24 months for Master's; 48 months for PhD), total number of courses, examinations (e.g. comprehensive, thesis defense, competency), progress reports, advisory committee)*

The program will be ten months in duration and will require completion of all twelve courses listed below totalling 31.45 units: two 1.6 unit courses; one 2.0 unit course; one 2.25 unit course; and eight 3.0 unit courses. Evaluation in each course will be a mix of team and individual assignments, case studies, presentations and exams. Students will receive regular feedback throughout the program as they progress through the courses. There is no final thesis or project required. The program is designed for working professionals and is similar in structure to existing programs within QSB such as the Master of Finance.

3.2 ***Course Requirements*** *– In Table 1 below, list core (required) courses (including project or thesis), optional courses (e.g. select X from the following list) and elective courses (indicate level and disciplines). Specify by field (academic plan) if appropriate. Identify those courses that are also offered to undergraduate students and are listed in the undergraduate calendar. Explain the rationale for including them in the graduate Program and confirm that at least 2/3 of courses taken to fulfill degree requirements are offered exclusively at the graduate level.*

Table 1. Course requirements *(add additional rows as needed)*

Course/Credit (number and name)	(C)ore, (O)ptional or (E)lective	Field *(if applicable)*	Undergraduate Enrolment (Y/N)	Proposed Instructor(s)	Academic Unit
MMA 801 Introduction to Management (1.6 units)	C		N	Gary Bissonette	School of Business
MMA 863 Mathematical Foundations for Analytics (1.6 units)	C		N	Jeffrey McGill, PhD	School of Business
MMA 860 Acquisition and Analysis of Data (3.0 units)	C		N	Keith Rogers, PhD	School of Business
MMA 831 Marketing Analytics (3.0 units)	C		N	Peter Dacin, PhD	School of Business
MMA 865 Big Data (3.0 units)	C		N	Mikhail Nediak, PhD	School of Business
MMA 841 Operations and Supply Chain Analytics (3.0 units)	C		N	Chialin Chen, PhD	School of Business
MMA 844 Project Leadership (2.25 units)	C		N	Kathryn Brohman, PhD/Barry Cross	School of Business
MMA 861	C		N	Yuri Levin, PhD	School of

Decision Models (3.0 units)					Business
MMA 867 Multivariate Statistical Analysis (3.0 units)	C		N	Jeffrey McGill, PhD	School of Business
MMA 823 Analytics for Financial Markets (3.0 units)	C		N	Matt Thompson, PhD	School of Business
MMA 830 Pricing Analytics (3.0 Units)	C		N	Yuri Levin, PhD	School of Business
MMA 864 Management of Analytics (2.0 units)	C		N	Yuri Levin, PhD/Jeffery McGill, PhD/Barry Cross	School of Business

3.3 ***Course Descriptions*** *- For each graduate course that is part of the proposed Program, provide a calendar description and append the course outline; also indicate if the course currently exists.*

Note: All courses within the Program are new courses, although many build on similar courses in other programs.

High Performance Teams (not for credit)

Building effective teams, being part of high performing teams, and managing the issues associated with teams are all critical challenges facing managers today. This introductory module helps students build an excellent set of skills for managing these challenges. It develops an understanding of the key elements of a high performance team, the difference between a group and a team and what leads to team effectiveness.

During the module, students are led through a set of practical sessions that reveal a five-step process for building high performance teams. Students not only improve their understanding of the steps necessary to develop a successful team but also develop the skill set necessary to become a more effective and supportive team member. The knowledge gained and the skill set developed are immediately transferable to the work place.

A combination of teaching methods is used throughout the module including briefings, individual style assessments, class discussions, videos, case studies, and team exercises. Key lessons and insights are discussed for the Master of Management Analytics team environment as well as the workplace.

Instructor: Shawna O'Grady

MMA 801 Introduction to Management (1.6 units)

This course introduces students to the main functional areas of business and demonstrates how these areas interact to produce and market products and/or services effectively and efficiently. A key focus is the development and application of business management skills and financial analysis for decision-making. This focus necessitates a base-level understanding (which the course delivers) of strategic fit, as well as market, operational, and financial risk. The course also helps students understand the nature of the modern corporate enterprise in Canadian and international contexts, and of the tasks, practices, and responsibilities of its managers. Among other topics, the course will discuss ethical and legal issues in the collection and use of data.

Instructor: Gary Bissonette

MMA 863 Mathematical Foundations for Analytics (1.6 units)

This course reviews mathematical background material that will be needed throughout the program. We will use the fundamental analytical framework of maximum likelihood estimation to motivate a review of basic probability concepts, likelihood functions, Bayesian analysis, linear algebra, and linear and nonlinear optimization. The focus will be on estimation of linear and nonlinear models that are often required for management analytics applications.

Instructor: Jeff McGill

MMA 860 Acquisition and Analysis of Data (3.0 units)

This course surveys the acquisition and preparation of data for basic statistical analyses and presentation. We survey both conventional and unconventional data sources including organized databases, online data capture, and point-of-sale data acquisition, and highlight challenges that each source can present. The hazards of 'data-fishing' will be emphasized – a particular theme will be maintaining focus in data collection towards a specific problem requiring solution. Topics will include formal and informal measurement methods, surveys, data screening and correction, and data summarization and presentation methods, followed by a review of statistical inference and regression modeling including an introduction to SQL. Parametric and non-parametric remedial measures for missing and censored data will also be studied.

Instructor: Keith Rogers

MMA 831 Marketing Analytics (3.0 units)

This course deals with aspects of the collection and use of consumer/customer information for the purpose of making marketing decisions. Through a hands-on approach, the course provides the skills necessary to understand and employ basic analytics to translate market-related information into specific operational plans in various marketing decision contexts. The course sets the foundation for participants to be intelligent, effective users of different marketing analytics techniques. Lectures, class discussions, assignments and software-based exercises will be the primary method used to understand these techniques. In addition, short in-class cases will be used to further illustrate, apply and reinforce learning. Approaches covered in this class include a variety of marketing analytics including those related to consumer choice, consumer preference, market response, market segmentation, and positioning.

Instructor: Peter Dacin

MMA 865 Big Data (3.0 units)

In this course, we discuss methods for knowledge discovery and predictive analysis using very large data sets (for example, click-stream and social network data). The course surveys statistical and machine learning techniques appropriate for different types of data as well as key technologies and applications that are driving the big data revolution. We contrast traditional and emerging NoSQL database technologies (e.g. *SQL* versus the *MapReduce* framework) and examine how Big Data affects interactions with IT departments within organizations. The course builds upon MMA 860 and also provides a foundation for using predictive models in data-driven decision making.

Instructor: Mikhail Nediak

MMA 841 Operations and Supply Chain Analytics (3.0 units)

In this course, we explore analytical issues in manufacturing and service operations, with particular attention to global supply chains. Specific concepts, decisions, and quantitative techniques commonly encountered in the management of operations and supply chains are emphasized. Analytical methods are a linking theme, but we also study strategic and tactical perspectives and highlight the competitive advantages that effective and efficient operations can provide for an organization. The interactions of operations with other business areas and with the environment are discussed along with how operations analysis can contribute to the achievement of organizational goals.

The course includes three modules: Controlling Operations Systems, Designing Operations Systems, and Integrating Operations Systems. Class time focuses on the key analytical concepts of each topic, and on the applications of this material in decision making within the operations function.

Instructor: Chialin Chen

MMA 844 Project Leadership (2.25 units)

Effective project management requires a skill set and leadership that, together, deliver discipline in planning, organizing, and managing resources to execute projects that meet strategic goals and objectives. Accordingly, this course takes a dual-pronged approach and covers concepts in the four

basic functions of project management (planning, organizing, directing, and controlling), but does it from a leadership perspective. A core focus in the course is learning how to create and drive an effective project environment within a company culture focusing on the area of data analysis. What can we do as leaders to ensure the organization launches and delivers projects well every time?

The course provides students with twenty-three instructional hours, which they can apply to certification requirements for either a Certified Associate in Project Management (CAPM), or (with additional training) a Project Management Professional (PMP) with the Project Management Institute (PMI).

Instructors: Barry Cross and Kathryn Brohman

Advanced Analytics Using SAS Enterprise Miner (not for credit)

The best way to achieve a working knowledge of commercial-grade business analytics systems is to gain familiarity with at least one such system. The SAS system is a major industry provider of business analytics software. This course will help students gain a complete understanding of how SAS software works and is used and will facilitate learning any other systems that they may encounter in their work lives. Students will learn how to perform ad hoc analyses and reporting in standard data environments with a specific focus on SAS Enterprise Miner. The course will prepare students for SAS Predictive Modelling Certification exam.

Instructor: Yuri Levin

MMA 861 Decision Models (3.0 units)

In this course, we explore the use of analytical methods in management problem-solving and highlight organizational and contextual issues. We study how to construct an analytical model of a problem that can be manipulated or solved to identify a decision that yields the best outcome, according to one or more carefully defined criteria. The challenges of selling and implementing model results in an organizational context will be explored through mini-cases and illustrations. We study both deterministic models – those that assume that the variables and outcomes in a decision problem are known with certainty – and stochastic models, which introduce elements of uncertainty or risk. We will examine examples of models of each type that are used in current practice. A key focus of the course is to link decision modeling methods to realistic data requirements.

Instructor: Yuri Levin

MMA 867 Multivariate Statistical Analysis (3.0 units)

In this course we study multivariate statistical methods that are most relevant to management analytics. After a review of multivariate distributions, sample geometry, and general linear models, we focus on important approaches to multivariate statistical analysis including categorical data analysis (log-linear models), multi-equation regression, principal components, classification methods, cluster analysis, and multidimensional scaling. We also review robust, distribution-free, methods for estimation of models and study remedial measures for missing or censored data. Emphasis will be on understanding underlying principles with frequent examples of real-word data sets.

Instructor: Jeff McGill

MMA 823 Analytics for Financial Markets (3.0 units)

The course focuses on statistical tools and models used in the financial sector with particular attention to analysis of large, evolving, datasets. The use of big data and analytical approaches to risk assessment, market segmentation, financial product development and pricing and other important activities will be discussed in the context of increasingly complex and integrated global financial systems. Applications may include retail banking analytics, inter-day book value assessments and tests, stress-testing, and monte carlo techniques for pricing complex financial instruments.

Instructor: Matt Thompson

MMA 830 Pricing Analytics (3.0 units)

Pricing and Revenue Optimization (PRO) focuses on how a firm should set and update pricing and product availability decisions across its various selling channels in order to maximize its profitability. Through a combination of case studies, lectures and guest speakers, this course reviews the main methodologies of analytical pricing and surveys current practices in different industries. The ultimate goal is for students to learn to identify and exploit opportunities for PRO in different business contexts. Within the broader area of pricing theory, the course places particular emphasis on tactical optimization of pricing and capacity allocation decisions, tackled using quantitative models of consumer behavior (for example, captured via appropriate price-response relations), demand forecasts and market uncertainty, and the tools of constrained optimization -- the two main building blocks of PRO systems. This course will build upon topics examined in MMA 867 and MMA 881.

Instructor: Yuri Levin

MMA 864 Management of Analytics (2.0 units)

This is a capstone course that ties together the concepts of the program and links them to the strategic objectives of organizations. Modules in Innovation, Managing Change, Ethics and Analytics will address implementation of analytics solutions that are consistent with the vision of the organization, and Building an Analytical Organization will examine senior management strategies for developing and using analytical expertise in organizations.

Essentially a course for leadership, this course prepares the student for roles as a General Manager, Executive or Director within the firm. With the use of an integrative exercise, analytics are applied to understand an organizational situation, leading to the formation of strategy and the managing the organization's destiny. Now that we understand Analytics, what do we do with them? An integrative case exercise will be a key part of the pedagogy.

Instructors: Barry Cross, Yuri Levin, and Jeff McGill

We are aware that some courses are better suited to for Saturday time slots versus an evening during the week to allow students to spend more time within a given topic. This will be taken into account when courses are scheduled.

It is the intent that all courses will make reference to, or utilize various software packages used in the industry. This is an important way in which they will learn to separate tools from principles.

3.4 ***Exam Requirements*** *– Describe the structure of comprehensive and Master's/Doctoral thesis examinations.*

N/A

3.5 ***Program Timelines*** *– In a table or figure, summarize the expected progress through the Program by term, to degree completion.*

Table 2. Expected program progression through to degree completion

Full Program Time Line – June – March each year											
Residential #1, June Kingston	**Module # 1, July - Aug**	**Module #2, Aug - Oct**	**Residential #2, Oct Kingston**	**Module #3, Nov - Dec**	**Module #4, Jan - Feb**	**Residential #3, March Toronto**					
801, 863	860, 831	841, 865	844	867, 861	823, 830	864					

3.6 ***Part-Time Studies*** *- If the Program is offered on a part-time basis describe how the delivery differs from that of the full-time Program and summarize the pathway to completion.*

N/A

3.7	***Progress Evaluation*** *- Describe the frequency and method of monitoring student progress and how it will be administered.*
	This is a course-based program. All for-credit courses will include assessments of student progress, which may include individual and team assignments, projects, presentations, and final examinations, and final grades will be assigned in all. The program is structured around three residential sessions and four eight-week modules during which complete courses will be delivered and graded. The program director will thus have frequent indicators of student progress and the ability to intervene in the event that difficulties are identified.
3.8	***Other*** *- Comment on any special matters and innovative features (e.g., the Program will be fully accredited by Canadian Association of Schools of Nursing).*
	The students will receive training that they can apply for a Certified Analytics Professional (CAP) with the Institute for Operations Research and the Management Sciences. The program provides students with twenty-three instructional hours, which they can apply to certification requirements for either a Certified Associate in Project Management (CAPM), or (with additional training) a Project Management Professional (PMP) with the Project Management Institute (PMI). As part of the program, the students will take Predictive Modeling Certification Examination administered by SAS. Students will also be placed into teams for the duration of the program. This will allow students to apply the team skills introduced during the first week of class for the entire program. Every team will be assigned a team advisor that is available to assist with any issue of team performance/dynamics that may arise and provide them with tools and skills to work through any concerns that are identified by the team. This provides students with team skills that are easily transferable to the workplace. In addition, by working in teams, students are able to assist each other as tutors should a team member require or request additional assistance in a particular course/topic. As teams interact regularly with faculty, this will allow any issues to be brought forward to faculty in a more timely fashion, ensuring that faculty can also address any issues a student may be facing by providing additional assistance. This provides more support for students to assist in the successful completion of the Program.

4.	**Program Content**
4.1	*Explain how the curriculum addresses the current state of the discipline and fields of study.*
	The program will provide thorough coverage of the fundamental mathematical and statistical theories and methods that underlie modern analytics but is designed with a practitioner focus. The program will be structured around three themes: descriptive analytics, predictive analytics, and prescriptive analytics, with the essential skills of understanding business issues and communicating with managers and coworkers woven throughout the program. It will be team based and have team-building exercises and communication workshops. We will introduce students to commercial-grade software packages for database management and statistical analysis, as well as other modern analytical packages used regularly by professionals. We will expect them to use these resources and explore different lines of attack to real-world problems. Students will be provided with significant opportunities to interact with mentors from the analytics community, both formally and informally.
4.2	*Identify any unique curriculum or program innovations or creative components.*
	This program is distinguished from other programs in Analytics offered at other institutions by two key features: the strong management component and real-world focus of the courses. The management context of analytics problems is crucial to proper choice of methods of analysis, and even the best results can be ignored if they are not communicated effectively to non-technical managers… "*People who can do high level math are practically a commodity…People who can figure out which problem is the right one to solve and then apply high level math are both expensive and elusive…Those who can*

communicate effectively the answer in such a way managers can understand… priceless." (Dave Clark, VP North American Fulfillment, Amazon.com quoted from http://bus.utk.edu/soms/analytics/curriculum.htm). The proposed program puts particular emphasis on developing communication and team-based skills --- major strengths of QSB professional programs and a key differentiator versus other schools.

4.3 ***Academic Integrity*** *- Explain how the Program educates students on the importance and role of academic integrity.*

In addition to the School's Academic Integrity web site, the academic regulations for all programs within QSB are posted on their respective internet portals, along with the policies relating to academic integrity and students' rights and responsibilities in this regard. This will be the case for this new Program. As part of the orientation for each incoming class, the Program Director will draw the students' attention to this issue and to sources of information relating to the potential consequences of breaches of academic integrity, including the QSB Academic Integrity policy, which explains what is expected of students with respect to academic integrity and to which students are required to adhere. The opening residential session of the Program will include a substantial discussion of academic integrity that focuses on writing practices that will help students avoid such breaches and guides them to sources of information on such matters as proper citation. Individual faculty members also set out in their course outlines specific instructions as to what may or may not be acceptable practices for their own courses (e.g. many do not require citation of materials they themselves have provided).

The treatment of ethics will be extended well beyond academic integrity issues to those affecting overall ethical conduct. There are important issues in the ethical use of data in business that will be covered wherever appropriate in the curriculum.

5. Assessment of Teaching and Learning

5.1 ***Degree Level Expectations (DLE)**** *– In Table 3 below, summarize how the Program's structure and requirements address each DLE listed as well as any additional program-specific DLEs (Refer to Graduate Degree Learning Outcomes GDLE, page 34 of QUQAPs for more information about graduate DLEs).*

Table 3. Mapping curriculum and degree level expectations (DLEs) *(add rows as needed)*

DLE	Learning Outcomes	Relevant Courses, Academic Requirement	Indicators of Achievement
Depth and breadth of knowledge	Graduates of this program will understand the mathematical and statistical principles that underlie Management Analytics, understand modern methods for search and retrieval of data, and possess practical experience with developing and applying analytical models to real world problems. They will also understand the organizational contexts in which analytics may be effective.	MMA 863 Mathematical Foundations for Analytics MMA 867 Multivariate Statistical Analysis MMA 861 Decision Models MMA 865 Big Data MMA 801 Introduction to Management MMA 864 Management of Analytics	1) demonstrated competence in identifying correct lines of attack to problems of business analytics; 2) expertise in modern algorithms, implementation techniques, and computer packages used in the practice of analytics; 3) expertise in business practices related to analytics.
Research and scholarship	This is a practice-oriented program; however,	MMA 860 Acquisition and Analysis of Data	1) demonstrated ability to develop novel approaches

	graduates should have the ability to create and implement novel approaches to Management Analytics and adjust these approaches in the light of unforeseen problems. They should have the ability to make informed judgments on complex issues regarding methodological design, data analysis, and findings. They should also have the ability to research company and economic data in the preparation of case analyses, and will be well versed in methods of empirical research; for example, in the proposal of hypothetical models and rigorous testing of those models with data.	MMA 863: Mathematical Foundations for Analytics MMA 867 Multivariate Statistical Analysis	to analytical problems; 2) knowledge of sources of data and methods of searching, extracting, summarizing and testing data from them.
Application of knowledge	Graduates will have the skills to develop, direct, and deliver projects in analytics that add value to businesses or other organizations.	MMA 823 Analytics for Financial Markets MMA 830 Pricing Analytics MMA 831 Marketing Analytics MMA 841 Operations and Supply Chain Analytics	successful completion of course or program projects that originate in real world business problems.
Communication skills	The program will foster the ability to communicate complex ideas, issues and conclusions clearly and effectively to both technical and non-technical audiences.	MMA 801 Introduction to Management MMA 864 Management of Analytics	1) strong writing samples and oral presentations in course work; 2) clear logic in all writing, in-class comments, discussions with colleagues, presentations, and networking, and 3) successful collaboration in project teams.
Autonomy and professional capacity	The program will develop the traits of personal responsibility and initiative necessary for business environments, the ability to work alone or as part of a team, the intellectual independence	High Performance Teams Preparation for SAS Certification MMA 844 Project Leadership	successful completion of professional certification exams and team projects in a diverse team environment.

	to be professionally engaged and current; and the ethical judgment necessary for responsible conduct.		
Awareness of Limits of knowledge	Graduates will be aware of the organizational contexts in which analytical methods may be effective. They will understand the assumptions underlying analytical models, appreciate the limitations of their ideas and existing analytic approaches; and recognize the complexity of knowledge and of the potential contributions of other interpretations and methods.	MMA 864 Management of Analytics	1) ability to contribute to discussions on topics related to analytics; 2) ability to situate integrate one's own work with other activities in a diverse team environment; 3) ability to explain analytics to others.

5.2	*Describe how the proposed methods of assessing student achievement relate to the Program learning outcomes and degree level expectations.*
	All courses will use one or more of the following methods of assessing student achievement: **Conventional assignments with problem-sets and, where appropriate, examinations**. [Learning outcomes: Depth and breadth of knowledge, research and scholarship] **Assignments that include case studies:** The case studies contain the messiness and imperfections of real problems and real data and illustrate the importance of the organizational context for analytics projects. The students will need to use different analytical techniques to solve important management challenges. In addition to a technical appendix, the submission will include a written report prepared for an audience that has little knowledge of analytics. [Learning outcomes: Application of knowledge, Awareness of limits of knowledge, Communication skills, Autonomy and professional capacity] **Projects and project presentations**: Where appropriate, courses will require teams to undertake projects or assignments based on real world analytics problems. These will typically be larger than any individual could complete on their own and involve presentation of the results either in a written report, a presentation to the class, or both. [Learning outcomes: Application of knowledge, Awareness of limits of knowledge, Communication skills, Autonomy and professional capacity]
5.3	*Outline the plans for documenting and demonstrating the level of performance of students (must be consistent with the OCAV's Graduate Degree Level Expectations). [Refer to Graduate Degree Learning Outcomes GDLE, page 34 of QUQAPs]*
	This program contains twelve for-credit courses, each of which will require assignments and final examinations or equivalent. Content covering all GDLE will be incorporated and evaluated in the various courses identified above. We propose criteria similar to those in our MBA and other professional programs: graduates must attain a passing grade in all courses and minimum average GPA of 2.7, and not have grades below 2.0 in more than 0.5 Queen's credits (3 units).

6.	**Mode of Delivery**
6.1	*Explain how the proposed mode(s) of delivery meets the Program learning outcomes and the degree level expectations. Comment on the relationship between mode of delivery and accessibility requirements.*

All courses will use one or more of the following delivery modes tailored to the goals of individual components.

Conventional Lecture Format: For background and principles courses.
[Learning outcomes: breadth of knowledge, research and scholarship]

Experiential Learning: The introduction to high performance team course will use team exercises to highlight the challenges of teamwork, and many course assignments will be team-assignments. We intend to use fixed, assigned, teams for the duration of the program, as we do in our MBA programs. This closely models the nature of teams in real organizations and forces students to confront and overcome challenges that that they may have with working in diverse teams that they have not self-selected. Thus students will 'learn by doing' throughout the program. Many courses in the program will have a project component. In these projects, the students will work with real company problems and data, which will give them the invaluable experience of applying concepts discussed in class to real-life settings.
[Learning outcomes: Application of knowledge, Communication skills, Autonomy and professional capacity]

Case analysis: Another type of experiential learning is achieved with cases from real organizations that contain the messiness and imperfections of real problems and real data and illustrate the importance of the organizational context for analytics projects. Such cases can include an analytical component or be used solely to illustrate an important management challenge.
[Learning outcomes: Application of knowledge, Awareness of limits of knowledge, Communication skills, Autonomy and professional capacity]

Projects and Project Presentations: Where appropriate, courses will require teams to undertake projects or assignments based on real world analytics problems. These will typically be larger than any individual could complete on their own and involve presentation of the results either in a written report, a presentation to the class, or both.
[Learning outcomes: Application of knowledge, Awareness of limits of knowledge, Communication skills, Autonomy and professional capacity]

Integrative Learning Opportunities: The last module of the program, Management of Analytics, is a capstone course that ties together the concepts of the program and links them to the strategic objectives of organizations. Modules in Innovation, Managing Change, Ethics and Analytics will address implementation of analytics solutions that are consistent with the vision of the organization, and Building an Analytical Organization will examine senior management strategies for developing and using analytical expertise in organizations. Essentially a course for leadership, this course helps the student understand the roles of General Manager, Executive or Director within a firm. With the use of an integrative exercise, analytics are applied within a larger context, helping in the formation of strategy and management of the organization's future. We understand Analytical methods, but how can we align those methods with broad organizational missions and objectives?
[Learning outcomes: Application of knowledge, Awareness of limits of knowledge, Communication skills, Autonomy and professional capacity]

With regard to accessibility, both the Queen's residential facilities and the new Toronto facility are compliant with modern architectural accessibility requirements. Most activities in the program will be classroom-based and accommodations will be made wherever necessary to accommodate students with disabilities.

6.2 ***Distance Delivery*** *- Where students may take the same Program or elements of it in two different modes of delivery, indicate how consistency in Program requirements and standards will be assured. Describe how a learning community will be fostered, how regular interactions with faculty, students, etc., will be assured, and comment on access to materials, resources, and technology.*

N/A

7. Anticipated Enrolment

7.1 Describe the recruitment strategy for the Program. Indicate how many new students the Program will attract to Queen's, and how many students must be accommodated by other departments/units. Indicate which departments/units will be affected and how.

Recruitment for the Program will be carried out in the same manner as our existing professional masters programs. Information sessions will be conducted both in person and on-line to accommodate the schedule of the target market. As the vast majority of the potential student pool is located in Toronto, information sessions will be held at the School's facility in downtown Toronto in both the lunch time and later afternoon time slots. This will allow potential students to attend an information session at a time convenient to them during their work schedule. For those who cannot participate in live information sessions, on-line information sessions will also be conducted and recorded to allow students to view them at their convenience via the internet.

The main target markets are graduates from business, engineering, mathematics, and computer science programs with 1-3 years of work experience. It is anticipated that the program will attract 40 – 60 new students to Queen's each year. Given that the program will be offered in our Toronto facility, there is no impact on other departments at Queen's.

7.2 In Table 4 below, summarize the projected intake and enrolments by year (by degree level and field as appropriate) until steady-state is reached.

Table 4. Intake and enrolment in Master's and Doctoral Programs*

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Masters							
Intake	40	50	60	60	60	60	60
Enrolment	40	50	60	60	60	60	60
Doctoral							
Intake	0	0	0	0	0	0	0
Enrolment	0	0	0	0	0	0	0
Total Enrolment	40	50	60	60	60	60	60

8. Resources

Provide evidence that the academic unit(s) has the necessary resources to implement and deliver the proposed new Program under the following headings (where applicable). ***Budget Module (see part E) must be completed.***

8.1 ***Faculty*** *- Comment on the adequacy of the faculty complement to teach and/or supervise in the Program and by field as appropriate AND complete Table 5 below.* ***Submit completed CV modules for all faculty listed.***

The Management Science and Operations Management area group responsible for this program is heavily involved in teaching in other programs in the School, but with faculty in the area group returning from sabbaticals and careful use of adjunct faculty, the program can be initially staffed without substantial adjustments to workload. No additional resources will be required in the initial offering of the program. In subsequent years the projected surplus would be used to hire additional faculty members in order to stabilize the program staffing. The information below indicates current teaching assignments with the new Master of Management Analytics added. If the program is approved, teaching loads would be revised for the 2013-14 academic year to allow for the addition of the new courses in faculty teaching loads. Some courses currently assigned to those faculty listed would be reassigned to other QSB faculty to allow for the faculty designated to the new program to take on course responsibilities as part of their teaching requirements.

All faculty selected to teach on the program have been with the School for a number of years and are familiar with our teaching methodologies, expectations and commitments. The faculty are noted for their excellence in teaching and/or research within Queen's School of Business.

Table 5. Faculty associated with the proposed Program *(add rows as needed)*

Faculty Member	Rank/Status *(Tenured, tenure track, continuing adjunct, term adjunct, special appointment, emeritus, etc.)*	Field	Home Unit	Total Undergrad Teaching (number of full term courses)	Total Grad Teaching (*incl new Program*), (number of full term courses)	Supervisory Privileges in New Program	Total Theses Supervised (M/D)	Current Theses Supervised (M/D)
Gary Bissonette	Assistant Prof./Continuing Adjunct	General Business	QSB	7.0	.5	N/A		
Kathryn Brohman, PhD	Assoc Prof/ tenured	Management Information Systems	QSB	1.5	3.5	N/A		
Chialin Chen, PhD	Associate Prof./Tenured	Operations Management and Technology	QSB	2.0	2.0	N/A		
Barry Cross	Lecturer/Continuing Adjunct	Operations Management and Technology	QSB	1.5	6.0	N/A		
Peter Dacin, PhD	Full Prof./Tenured	Marketing	QSB	0	5.0	N/A		
Yuri Levin, PhD	Full Prof./Tenured	Management Science	QSB	3.0	5.25	N/A		
Jeffrey McGill, PhD	Full Prof./Tenured	Management Science	QSB	0	4.75	N/A		
Mikhail Nediak, PhD	Assistant Prof./Tenure-track	Management Science	QSB	2.0	3.0	N/A		
Keith Rogers, PhD	Assistant Prof./Continuing Adjunct		QSB	4.0	1.0	N/A		
Matt Thompson, PhD	Assistant Prof./Tenure-track	Management Science	QSB	4.0	2.0	N/A		

8.2 ***Staff*** *- Comment on the adequacy of the staff complement to support the Program (administrative, technical, IT, laboratory, etc.).*

There will need to be financial resources allocated to administration staff as the program enrolment increases after the first year. One additional staff member will be required to address the added administrative load as class size increases to 60. The staff member will join the existing team supporting the Master of Management and Executive MBA programs. The proportional allocation of all teaching and staffing costs has been included in the budget attached.

8.3 ***Space Requirements*** *- Describe the work space, laboratory space, office, classroom and equipment needed to support students' scholarship and research activities.*

Most of the teaching for the program will be conducted in our downtown Toronto facility. It consists of a main classroom that can accommodate 60 students as well as breakout rooms and lounge. Administrative staff at the facility will be present during class times to assist both the faculty and students. Recruitment and application processing will be administered by our Executive MBA operations office which provides such services for our Executive MBA programs, Master of International Business and Master of Finance

Programs. The addition of the Master of Management Analytics program can be accommodated in this office. The program will be assigned an Academic Director, who is a faculty member within the Management Science and Operations Management Area Group within the School. Dr. Yuri Levin will assume this responsibility.

8.4 ***Information Technology -*** *Describe the information technology needed to support students' scholarship and research activities. Indicate the resource implications for hardware, software/internet, audio-visual, telecommunications, etc.*

All students will receive the same level of IT support as our other Masters programs. A full wireless network has been installed in the Toronto facility providing students, faculty and staff with complete access to the internet. A program administrator will be assigned to the Analytics program providing students and faculty in the Program with administrative support.
Administrative staff can be accommodated in current facilities.

8.5 ***Library -*** *Provide information about library support holdings, availability of and access to library resources relevant to the proposed Program(s).*

Given that the program is not research intensive and is delivered in Toronto for the majority of the Program, we anticipate no increase in the use of library resources. This was confirmed in a conversation with senior library staff on August 28.

*Indicate what **new** library resources will be needed (e.g. journals, print monographs, audio-visual material, historical documents, electronic databases, statistical/geospatial data)*

No requirements for new library resources are anticipated

Indicate the likelihood of the Program having an impact on the Library staffing. Provide date that consultation with the Library staff took place.

No impact on library staffing is anticipated.

8.6 ***Research Funding -*** *Provide evidence of adequate research funding to sustain the research activities of faculty and graduate students AND complete Table 6 (below).*

This is a professional program and as such will not require any research funding.

Table 6. Research funding (operating) by source ***(****do not include conference grants, SSHRC minor grants or equipment grants****). Include last 3 years only. [add additional rows as needed]***

Year	Field	Federal Granting Council	Other Peer Adjudicated	Contracts	Other
N/A					

8.7 ***Student Funding -*** *Indicate if graduate students in the new Program will receive funding packages. If yes, state the minimum annual funding support (by degree level) and describe how the funding commitments will be met.*

N/A

In Table 7 below, summarize the approximate dollar amounts associated with each source of funding as well as Tri-council scholarships for which students may apply.

Table 7. Projected financial support for students at Program launch

	Tri-council	Other External Awards	Internal Scholarships	TAs	RAs	Other *(specify)*	Total *(Avg/student)*
			QSB Dean's Entrance Scholarship - $25,000 total available				Variable, to a Maximum of $5,000

8.8	*Describe any additional resources required that are not currently available. Provide evidence of institutional commitment to supplement existing resources as needed (See Budget module).*
	Students may be eligible for need-based assistance. It is expected this demand will be limited.

9. Other Matters

9.1 *Provide evidence of student demand for the Program and describe how this information was obtained.*

Feedback from Prospective Employers and Candidates

We conducted personal interviews with 13 prospective employers in April and May 2012, all of which were in Ontario, in the Greater Toronto Area. In May 2012, 7,000 Queen's alumni were emailed a survey as potential candidates for the program (graduates of Commerce, MBA, Engineering, Computing Science). The response rate of just over 4% (303 responses) is considered good for online surveys. The list included a large number of out-dated addresses. The feedback proved to be very insightful. The results were extremely helpful in providing clarity regarding the target audience: those with an undergraduate degree in business, math, engineering or the sciences, who have been working for one to three years. We are now able to further target this market in promoting the program. Our experience in delivering programs of similar design support the viability of this proposed program given the niche market it serves and the fact it is a unique program offering in Canada at this time. Highlights from each of these information sources include:

Employer Feedback:

- The majority of the companies surveyed agree with proposed content including modules in communication skills and teamwork.
- The majority of companies saw only modest benefit in the program having a co-op/internship component, and most would not be interested or able to accept students into co-op/internship positions within their organization.
- The majority of companies view work experience as useful but not critical for graduates of this program to be considered for positions in their organization. A common view was that they badly needed people with these skills and would provide any company-specific training.
- Employer feedback is generally consistent with the data from McKinsey & Company that recently estimated that, in the U.S. alone, the demand for persons with deep analytical training "…could exceed the supply being produced on current trends by 140,000 to 190,000 positions…". In addition to this, they "…project a need for 1.5 million additional managers and analysts in the United States who can ask the right questions and consume the results of the analysis of big data effectively…". (McKinsey & Company)

Candidate Feedback:

- The survey of potential students indicates that the target market is students who have an undergraduate degree in business or engineering with 1-3 years or work experience; however, those with up to 10 years of experience also expressed interest.
- Of those alumni surveyed, 32% (96 of 303 responses) indicated that they would be interested in taking an analytics program. Of those 96, 87% stated such a program would be valuable, very valuable or extremely valuable for advancing their career.
- 74% indicated they would prefer a program that was 12 months in length or shorter, with 54% indicating that they would prefer a program that was a mix of evenings and weekends and 26% weekends only.

9.2	*Explain how the Program will fulfill societal need. Comment on similar programs offered elsewhere and why the proposed program will be attractive to applicants (include any unique or innovative elements/features).*
	As outlined above, there is a significant and growing need for skilled analysts who can cope effectively with extremely large data sources and understand management and organizational contexts for analysis. The most obvious demand for such graduates is in business, but the need is not limited to that sector. For example, we are aware of growing interest in government, health care and other non-profit sectors for improved analytics capability. Regardless of the application area, effective use of the tremendous volumes of data now available to organizations can lead to important societal benefits; for example, more efficient allocation of resources in an era of tightening budgets and environmental stress, better targeting of products and services to customers and clients, improved risk management, and greater profitability and stability of businesses that employ thousands of citizens,. There are a number of programs in the U.S. and one that we know of in Canada (recently announced at York). Many programs are positioned in statistics or computer science departments, but there are a few exceptions. For example Northwestern's Kellogg School of Management is launching a program this fall and the York program is at the Schulich School of Business. Our program is distinguished by the inclusion of significant management content and by the fixed team model that has been so effective in other programs at the School of Business. We also have a reputational advantage from both Queen's and the School of Business. Finally, the enthusiastic response to this proposal that we received from industry suggests that there is ample room for more than one program in the Toronto area.
9.3	*For new Professional Programs, provide evidence that the Program is congruent with the regulatory requirements of the profession.*
	There are no regulatory body requirements for this field.
9.4	*For research-focused graduate programs, provide a clear indication of the nature and appropriateness of the major research requirements for program completion.*
	N/A

10.	**Equity, Diversity and Accessibility**
10.1	*Describe how the proposed new Program will address equity considerations, including (but not limited to) issues of particular concern for the groups identified in the University's various Equity programs (http://www.queensu.ca/equity/).*
	As Queen's University recognizes that some persons with disabilities may use personal assistive devices while accessing any service or location of the campus, excepting in circumstances where the use of a personal assistive device contravenes policies and/or legislation governing the delivery of particular services, the program will ensure that all policies and facilities reflect statement. The facility in Toronto is fully accessible. The classroom can easily accommodate those with special needs including wheelchairs and walkers. Given the high level of technology in the facility, those with personal assistive devices should be able to be accommodated. In addition, students will be made aware of services available via Queen's Health Counselling and Disability Services so that they may receive information and guidance as to how to make arrangements for accommodation they may require.

10.2	*Provide information about the representation rates of members of designated groups within the faculty and identify gaps in representation as compared to the appropriate Canadian workforce population.*
	While there is an appropriate mix of international and national faculty involved in the program, there is a slight under representation with respect to gender. Only 10% of the Program faculty are female. However, this is typical of the industry as the field of analytics tends to be a male dominated profession. We view this as an appropriate mix given the industry demographics, but aim to improve the ratio as more women become involved in this area as academics and practitioners.

11.	**Quality and Other Indicators**
11.1	*Define indicators that will provide evidence of the quality of the faculty and how they will be used (e.g. qualifications, teaching effectiveness, supervisory/mentorship ability, research impact, innovation and scholarly record; appropriateness of collective faculty expertise to contribute substantively to the proposed program).*
	All faculty teaching on the program have been selected based upon their years of service within the School and their excellence in teaching. The core of the faculty are from the Analytics area, bringing many years of solid research and practical application to the classroom. Others have excellent teaching and research ratings in other areas that bring value to the program such as in the areas of general management and finance. All have experience in teaching at a masters level and have worked with students who are working professionals. QSB has several programs that serve this student demographic such as our Executive MBA Program, Accelerated MBA Program for Business Graduates, Cornell-Queen's Executive MBA Program and Master of Finance Program. Faculty are able to bring that teaching experience into the Master of Management Analytics Program.
11.2	*Comment on the Program structure and faculty attributes (including research activity) that will ensure the intellectual quality of the student experience.*
	The program is a course based masters program. The majority of the faculty are currently doing research and/or have published in their area of expertise. Others also consult in both the private and public sectors. They are able to bring both the research and practical application aspects of the subject matter into the classroom, providing students with relevant and up-to-date knowledge in the area.

Supporting documentation

Embed relevant documents supporting the proposal (e.g. letters of support from Deans, Department Heads, collaborators, external agencies, etc.) by inserting the letters as Word Documents. If the letters are .pdf documents, it is essential that they are first converted to Word documents using Adobe Acrobat Software to avoid loss of resolution and formatting. If you do not have Adobe Acrobat, please consult your faculty office.

Most companies are confident that graduates of this program will be in high demand. These are just some quotes:

- *"We've watched as corporations turn the discussion from "spending money to save money", to "spending money to make money", and that discussion is underpinned by the Big Data opportunity at every company's doorstep. There is a critical demand for people with the ability to analyze and create value from Big Data, and I believe the Queen's Master of Management Analytics program provides the skills that are required."*
  Paul Zikopoulos, Director of Information Management, IBM

- *"We are making huge strides in utilizing big data to drive new insights for business decision making, and this is largely being driven by people with the kinds of skills the Queen's Master of Management Analytics program is providing."*
  John Souleles, Director of Business Intelligence, Bell Canada

- *"We are pleased to be working with Queen's School of Business and their Master of Management Analytics program. I believe that graduates of this program will be in great demand."*
  Jerry Oglesby, Senior Director, Global Academic Program & Global Certification, SAS

- *"For an organization to compete today, it has to embrace modern business complexity and harness the incredible power of data. A successful business now requires a proficient team of managers with both an in-depth knowledge of analytical tools and expertise in business. This Queen's program will be producing graduates with the knowledge and skills to be excellent business managers and analysts."*
  Dr. Yuri Medvedev, Chief Mathematician, Bank of Montreal

- *"Our interdisciplinary Analytics Team has successfully delivered insights that have influenced critical business decisions, transformed client relationships and opened up entirely new lines of business. As we grow, we are always looking for that special blend of skills that span the traditional boundaries between business intelligence, information technology, and customer engagement – exactly the skills that Queen's Master of Management Analytics is teaching."*
  Osgood Vogler, Director of Analytic Services, Celestica

Part C – Administration & Government Reporting Information

Part C is to be completed by the Department/Faculty in consultation with the Office of the University Registrar and the School of Graduate Studies.

12. Information for and/or from the Office of the University Registrar and/or the School of Graduate Studies Registrar	
12.1. Academic Administration	
Academic Career	GRAD
Department(s)	
School of Business	
Proposed Start Date 06/2013 (mm/yyyy)	Program duration 10 months
Expected enrolment *Initial Year* 40 *Steady State* 60	
Program Name: Degree *(max 50 characters) (e.g. Master of Applied Science)*	Degree Code *(max 5 characters) (e.g., MASC)*
Master of Management Analytics	MMA
Academic Plan *(e.g. Chemical Engineering)*	Academic Sub-Plan *(e.g. Specialization in Collaborative Biomedical Engineering)*
Management Analytics	
Collaborative Program Sub-Plan *List all departments/plans that may admit students into the Collaborative Sub-Plan. Indicated department with primary responsibility for Sub-Plan (**underline)***	
NA	
Pattern of Study *(Master's programs only; choices: Pattern I, II, III)*	III

12.2. Complete the following:		
Will students be admitted part-time?	☐ Yes	X☐ No
Will all or part of the program be offered at the BISC campus?	☐ Yes	X☐ No
Will all or part of this program be offered via distance learning (e.g. online or blended learning?)	☐ Yes	X☐ No

13. Course Information		
New Courses with new subject code required?	X☐ Yes	☐ No
If yes, suggested Subject Code ~~MMA (Management Analytics)~~		

14. Tuition and Student Activity Fees	
Tuition Fee	Domestic - $37,000 Program fee = $31,122 tuition + $5,878 non-tuition, International - $55,000 Program fee = $49,122 tuition + $5,878 non-tuition
Fee Assessment Protocol *(Annual? Per term Or per course?)*	$37,000 divided equally across the 3 terms
Student Activity Fees *GRAD - SGPS*	As the students are not on campus to receive services/benefits and it is expected that the majority of students will be working full time while enrolled in the program, it is anticipated that Student Activity Fees will not apply as is the case with programs delivered in a similar manner such as the Master of Finance Program, also delivered off campus in the QSB Toronto facility.

15. Government Reporting	
Proposed FORPOS	244
Program Weight (BIUs)	1.0
Proposed CIP Code	52.1299

Part D - Authorizations

Part D is to be completed by the SGS following GSEC approval.

Date Approved by GSEC	**September 20, 2012**	
Department Head(s)	*Signature*	Sept 24, 2012 *Date*
	Signature	
Faculty Dean(s) or delegate(s)	*Signature*	24 Sept '12 *Date*
University Librarian	*Signature*	25 Sep 12 *Date*
University Registrar	*Signature*	Sept 25, 2012 *Date*
Chief Information Officer and Associate VP (Information Technology Services)	*Signature*	Sept 25 2012 *Date*
Vice-Provost and Dean, School of Graduate Studies	*Signature*	Sept 26 2012 *Date*
Vice-Provost (Planning and Budgeting)	*Signature*	Sept 26/2012 *Date*
Provost and Vice-Principal (Academic)	for ~~A Harrison~~ *Signature*	30 Sept 2012 *Date*