February 17, 2015

Prasad A. Naik, Ph.D.
Graduate School of Management
University of California, Davis
One Shields Avenue
Davis, CA 95616

RE: Master of Science in Business Analytics

Dear Prasad:

I am pleased to endorse the proposal for a new graduate degree program, the Master of Science in Business Analytics. As part of an effort to meet the increasing demand for business leaders who are proficient in analytics, the M.S. in Business Analytics provides a unique opportunity for the Graduate School of Management to strengthen our portfolio of programs and capitalize on clear synergies with the campus Big Data initiative. Aimed at developing future leaders who are able to transform business problems into an analytics framework, this program will also strengthen the School’s partnership with the business community by preparing students to apply analytics to data to create business value and communicate effectively to inspire action.

It is my honor to join with our School’s faculty in support of this proposal and ask for careful consideration and approval of the Master of Science in Business Analytics.

Sincerely,

Ann Huff Stevens
Dean
Proposal for the Master of Science in Business Analytics

A Departmentally-Based, Self-Supporting Professional Graduate Program Offering the Master of Science in Business Analytics (MSBA)

From the Graduate School of Management

Steering Committee: Professors Hemant Bhargava and Prasad Naik

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Version: May 29, 2015
Executive Summary
Master of Science in Business Analytics

I. Introduction

The conduct of business has undergone major transformation, as modern information technologies endow firms with massive amounts of data. Consequently firms face a shortage of skilled workers and managers who can leverage massive data and computing power to extract insights, improve decisions, and create business value. McKinsey Global Institute report estimates that by 2018 “the United States alone could face a shortage of 1.5 million managers and analysts with the know-how to use the analysis of big data to make effective decisions.”1 According to the Chief Data Scientist of BAE Systems (see Appendix B) who reviewed our draft proposal, there is a “… growing need for trained professionals at the intersection of business and analytics.” To meet this need, the proposed degree program of Master of Science in Business Analytics (MSBA) will provide employers with analytically trained professionals with the knowledge of business domains.

The discipline of business analytics serves an important role in society by creating and disseminating scientific knowledge in the use of data and analytics to solve complex business problems, gain insights, make informed decisions, manage uncertainty, improve business performance, and communicate effectively the problem formulation, solution, and the course of actions.

The mission of the MSBA program is (i) to develop business leaders proficient at extracting business value from data and analytical methods; and (ii) to advance the science and practice of business analytics.

II. MSBA Program

Prospective Students
The program requires an undergraduate degree in a quantitative field. Although no restrictions exist on major, it builds on students’ aptitude for statistics, mathematics, computer science, economics, or business. It targets both full-time students (domestic and international) and working professionals with either part-time jobs or full-time jobs that treat program work as professional development time.

Program Features
- Degree: Master of Science
- Administrative home: Graduate School of Management
- Steering committee: Profs. Hemant Bhargava and Prasad Naik
- Starts in Fall 2016
- 30 credits of graduate coursework during Fall, Winter, Spring quarters

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1 http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation
10 credits for project and project-related coursework over Fall, Winter, Spring, and Summer
- Tuition $52,000 similar to related programs, including the MSBA program at UCSD
- Initial class of 40 students, with 2 faculty FTEs, 1 executive director, 4.95 staff FTEs
- Scales up to 80 students from Year 3 onwards, with 5 faculty FTEs, 1 executive director, 6.20 staff FTEs
- Classes held in the GSM San Ramon campus during the time slots currently unutilized, e.g., a combination of one or two weekdays plus the unutilized time slots on weekends
- Self-supporting degree program (SSDP), departmentally-based, terminal degree.

These program features are based on research and consultation with faculty and corporate leaders. As one of the external faculty reviewer, Associate Dean Sridhar Narasimhan at Georgia Tech., writes, “I am impressed with the thought and care that has gone into preparing this document.” Another reviewer, Prof. Terrence August from UC San Diego, states, “It is clear that the program chairs have carefully constructed a rigorous program that will graduate successful leaders who can spearhead business analytics initiatives.”

Project
The MSBA curriculum devotes 10 credits to a “real world” Business Analytics project, accounting for 25% of the total credits hours. Students form a 4-member team to work on a 10-month long project that provides opportunities to solve complex business problems for an external organization, starting from transforming a business problem into an analytical framework, collecting and analyzing data, extracting insights, and recommending actions.

External faculty reviewers who designed and launched similar programs have commended our program design (see Appendix A). For example, Prof. Terrence August of UCSD states, “I really like the program design and the integrated approach being taken. The commitment of 25% of the curriculum dedicated to an ongoing, real world business analytics project is quite commendable. This aspect certainly stands out from other business analytics programs and ... graduating students will have a competitive advantage in the marketplace.”

III. Competitive Landscape

At present, no university in the UC system offers an MSBA program. UC Davis was the first in the UC system to offer a Business Analytics concentration in its MBA program since 2007. In summer 2014, UCSD proposed an MSBA program, which is under review. The University of Southern California plans to start its MSBA in 2015. Appendix C lists many universities across the nation that offer Master of Science degree in Business Analytics.
Some universities offer non-MSBA programs in analytics or data science that do not focus on business as the domain area. For example, UC Berkeley offers Master of Information & Data Science, which is an on-line working professionals program run by the School of Information. University of San Francisco has also recently begun an 11-month master’s program in analytics with a distinctly technical flavor.

Consistent with McKinsey Global Institute report\(^2\), industry leaders perceive a substantial shortfall in the supply of analytically trained business professionals. For example, Dr. Don Dini and Dr. Rishiraj Pravahan, Principal Data Scientists at AT&T Foundry, wrote in their letter (see Appendix B), “we already feel the necessity for managers trained with the technical knowhow of data analytics and feel there are very few academic programs that address this demand.” Given this demand and supply gap, all of these programs are heavily oversubscribed. For instance, Northwestern University’s master’s program attracted 600 applications for 32 seats.

IV. Budget Implications

Appendix C presents class size and program fees at various universities. Consistent with these figures, the MSBA degree program at the Rady School of Business of UC San Diego proposes to enroll an average of 40 students with fees ranging from $52,900 to $59,800 in the first 5 years. Their proposal has been approved by the Graduate Council and Representative Assembly of UC San Diego. We seek to maintain parity with UC San Diego’s program, and propose 40 students per year with fees of $52,000 per student.

Based on this projection, the first-year revenues equals $2.11 million. Enrollment doubles in Year 3, due to two sections of 40 students each given the available classroom sizes in GSM San Ramon campus, resulting in revenues of $4.47 million. To bootstrap the launch of this program, current GSM faculty and qualified faculty from other departments at UC Davis will teach on an overload basis until one executive director and five new faculty are hired. The budget includes funds to cover this overload teaching and other expenses for visiting faculty, teaching assistants, staff support, as well as the long-term benefits for staff and faculty. Year 1 revenues exceed all program costs by 11.2%; in steady state from Year 3 onwards, the surplus ranges from 8.82% to 10.75%. Thus, the program is self-funded by student fees and uses no state funds.

V. Cross-department consultation, Employer Support, and GSM Faculty Vote

This proposal was developed with extensive consultation with and feedback from faculty within GSM and Davis campus (DSI Director, faculty or department chairs in Statistics, Mathematics, and Computer Science), several industry leaders in California and US, GSM Business Partners, GSM Alumni Association Board members, and GSM alumni.

The program design has received high praise and strong support from prospective employers (see Appendix B). For example, Mr. Scott Guckin from Kaiser Permanente

\(^2\) http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation
wrote, “I am also excited about the San Ramon proximity to our IT operations in Pleasanton and I see potential for hiring opportunities when this program is up-and-running.” Similarly, Dr. Rajat Mukherjee, Head of Ecommerce, Yahoo Small Business, expressed strong support for “bringing in students with such skills into our group … as such analytical background and skills are often in short supply.” Dr. Harold Schmitz, Chief Science Officer at Mars Inc. wrote “… the proposed program content is solidly designed in terms of its mix of tools, techniques, and domain knowledge … We are pleased to offer support at this time … in hiring and placing graduates and in providing financial or other support for the most distinctive elements of this program.”

Similarly, Mary Maffly, Director of Development & Alumni Relations at GSM summarizes the excitement and enthusiasm of the GSM alumni and Business Partners:

“When I shared the potential of the new degree, it seemed all of the alumni I spoke with were sharing similar sentiments … there is a strong need for the skill sets that a Master’s in Business Analytics will provide prospective students. It is rare to find individuals who have both the technical and the business skills to take the data and analyze it in a way that will help inform business decisions. Our alumni are very excited to get involved either personally or through their companies to help move this proposal forward.”

This excitement is shared by external faculty reviewers, as noted in the comment: “This is an excellent proposal for a highly impactful degree program. Having this program, as designed, up and running would be an immediate success for both UC Davis GSM and bay area companies that have a demonstrated need for human resources with these important skill sets. Moreover, society will directly benefit in the future from new, improved, and even evolved products and services ...”

Given the above need, opportunity, and excitement, the GSM Faculty met on January 28, 2015 to discuss the proposal to establish the departmentally-based, self-supporting degree program in Master of Science in Business Analytics (MSBA). By GSM Faculty vote, the proposal was unanimously approved. Dean Ann Stevens also endorses the MSBA program (letter enclosed).

After incorporating feedback from multiple constituencies (see Appendices E and F), we are delighted to put forth this revised and improved proposal for review by the University of California.
Table of Contents

Section 1. Introduction ............................................................................................................. 3
  1.1 Aims and objectives of the program ................................................................................. 3
  1.2 History and development ................................................................................................. 4
  1.3 Timetable for development .............................................................................................. 6
  1.4 Relation to campus academic plan .................................................................................. 7
  1.5 Interrelationship with other University of California institutions ................................. 7
  1.6 Departmentally-based graduate program ....................................................................... 8
  1.7 Program evaluation ........................................................................................................ 8

Section 2. Program .................................................................................................................... 9
  2.1 Undergraduate preparation ............................................................................................. 9
  2.2 Foreign language ............................................................................................................ 12
  2.3 Program of study ........................................................................................................... 12
  2.4 Field examinations ....................................................................................................... 14
  2.5 Qualifying exams ........................................................................................................... 14
  2.6 Thesis and/or dissertation ............................................................................................ 14
  2.7 Final examination ......................................................................................................... 15
  2.8 Explanation of special requirements ............................................................................ 15
  2.9 Relationship of master’s and doctoral programs ......................................................... 15
  2.10 Special preparation for careers in teaching ................................................................. 15
  2.11 Sample Program ......................................................................................................... 15
  2.12 Normative time to degree ........................................................................................... 16

Section 3. Projected Need ........................................................................................................ 16
  3.1 Student demand .............................................................................................................. 17
  3.2 Opportunities for placements of graduates .................................................................. 19
  3.3 Importance to the discipline ......................................................................................... 22
  3.4 Needs of society ............................................................................................................ 23
  3.5 Relationship to professional interests of the faculty .................................................... 23
  3.6 Program differentiation ................................................................................................. 24

Section 4. Faculty ................................................................................................................... 25
  Summary of Faculty Qualifications .................................................................................... 26

Section 5. Courses .................................................................................................................. 31

Section 6. Resource Requirements ....................................................................................... 37
  6.1 FTE faculty .................................................................................................................... 37
  6.2 Library acquisition ....................................................................................................... 37
  6.3 Computing costs .......................................................................................................... 38
  6.4 Equipment .................................................................................................................... 38
  6.5 Space and other capital facilities .................................................................................. 38
  6.6 Other operating costs ................................................................................................. 39
Section 7. Graduate Student Support ................................................................. 44
  7.1 Return to Aid, Awards, and Fellowships ............................................ 44
  7.2 Loan Repayment and Scholarships .................................................... 45
  7.3 Underrepresented Students ................................................................. 45
  7.4 Additional Financial Aid Programs ....................................................... 45

Section 8. Governance .................................................................................. 45

Section 9. Changes in Senate Regulations ................................................... 46

APPENDIX A – Letters from External Faculty

APPENDIX B – Letters from Companies and the GSM Alumni Association Board

APPENDIX C – List of Universities offering MSBA degree

APPENDIX D – Budget Spreadsheet

APPENDIX E – Responses to External Faculty Letters

APPENDIX F – Incorporated Feedback from Multiple Constituencies in GSM

APPENDIX G – Bylaws of the MSBA program

APPENDIX H – Degree Requirements in the Format of the Graduate Council

Acknowledgements: We are grateful to Dr. Sanjay Saigal for substantial help in conceptualizing this proposal; to Aditi Raipet (MBA 2009) and Onyeka Enwerem (MBA 2014) for conducting research, competitive analysis, and needs-gap analysis; to Amanda Steidlmayer for extensive help in developing the program’s financial projections; to Su-lin Shum and Seija Virtanen for budgetary review; to Prof. Duncan Temple Lange (Director of Data Science Initiative) for inspirational ideas and invaluable feedback in curriculum design; to Amanda Kimball for implementing the curriculum design; to Madelin Dana for document preparation; to Vivian Mendoza for guidance in efficiently navigating the proposal review process; to Mary Maffly for championing the MSBA proposal to the GSM Alumni and Business Partners.
Section 1. Introduction

Big data and analytics represent the fastest growing professional skill-sets in Northern California’s knowledge economy. Companies are facing an acute shortage of skilled workers and managers who are trained to leverage massive data and computing power to extract insights, improve decisions, and create business value. McKinsey Global Institute report estimates that by 2018 “the United States alone could face a shortage of 1.5 million managers and analysts with the know-how to use the analysis of big data to make effective decisions.”\(^1\) According to the Chief Data Scientist of BAE Systems (see Appendix B) who reviewed our draft proposal, there is a “… growing need for trained professionals at the intersection of business and analytics.” Thus a serious gap exists between the needs of business and the availability of analytics-savvy professionals.

To meet this need, the proposed degree program of Master of Science in Business Analytics (MSBA) will provide employers with analytically trained professionals with the knowledge of business domains. Such professionals, according to Harvard Business Review,\(^2\) will hold “the sexiest job of the 21st Century.” This field of business analytics serves an important role in the society by creating and disseminating scientific knowledge in the use of data and analytics to solve complex business problems, gain insights, make informed decisions, manage uncertainty, improve outcomes, and communicate effectively the problem formulation, solution, and course of actions. To this end, the mission of the proposed MSBA program is (i) to develop business leaders proficient at extracting business value from data and analytical methods; and (ii) to advance the science and practice of business analytics.

1.1 Aims and objectives of the program

The MSBA program addresses the vast demand-supply gap of professionals capable of using data and analytics to generate business value. It aims to admit professionals with an undergraduate degree in a quantitative field and build on their aptitude for statistics, mathematics, computer science, economics, or business. It targets both full-time students

\(^1\) http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation
(domestic and international) and working professionals with either part-time jobs or full-time jobs that treat program work as professional development time.

The objectives of the program are to

- develop business leaders proficient in analytics by providing educational and research opportunities to students;
- prepare students to use data and analysis to identify business opportunities and create business value; and
- advance the science and practice of business analytics by bringing together faculty, students, and companies to promote research, teaching, and outreach.

1.2 History and development

In 1954, the Ford Foundation set out to reform business education in American universities from practitioner-oriented teaching to an academically-grounded discipline. The Foundation began by investing $35 million over 12 years through grants to four universities: Harvard University, Columbia University, University of Chicago and the Carnegie Institute of Technology. That funding eventually expanded to over 200 business schools nationwide, which went on to develop new curricula and train a new generation of research-oriented business faculty. Management thinkers, destined to be regarded as the Brahmins of the corporate ecosystem, rigorously derived new knowledge and unexpected insights using the methods of social sciences such as Economics, Psychology, Sociology, and History.

Over sixty years, this process led to the modern business school, with research and practice creating new first rank academic disciplines such as Marketing, Operations, Organizational Behavior, Finance and Accounting. Professors edited new journals, organized new conferences, and developed new institutions that formalized management pedagogy, disseminating it to the field through successive ranks of Master in Business Administration graduates, the MBAs.

Today, the MBA is not only valued by employers who pay salaries above the campus average, it is also much sought by prospective students from diverse undergraduate majors as a transition to a business career and eventual corporate leadership. The Foundation’s impact spread worldwide,
first to universities in the developed world (especially to Western Europe and Australia/NZ) and then to emerging economies (e.g., China and India).

Meanwhile, the 1990s placed business activity on a high-speed data ramp, following the Clinton-Gore administration's promotion of the Information Superhighway, massive commercial investments in high-speed bandwidth, and the universalization of TCP/IP protocols for wide-area networks. E-commerce began on August 11, 1994 with the first secure transaction on NetMarket. Subsequent developments over the last 20 years —— online transaction processing, supply chain management, electronic data exchange, automated data collection, and ubiquitous mobile commerce —— left businesses inundated with data.

Businesses today seek new and creative strategies to utilize data. An organization’s store of “Big Data” is considered its most critical economic asset. However, businesses find that leveraging data requires far greater analytical sophistication than available from traditionally-trained MBAs. That realization has led to the rise of “the quants”, first on Wall Street, then in IT and allied knowledge industries, and now, across sectors. Today’s savvy CEOs and COOs adapt business techniques as readily from STEM disciplines (sciences, technology, engineering, and mathematics) as their professional forebears did from the social sciences.

To elaborate this point, consider the emergence of the Insight Data Science Fellows program based in Silicon Valley\(^3\) to re-train recent STEM PhDs for business analytics leadership. Insight’s six-week program places its newly-minted data scientists not just at data-focused Silicon Valley companies like GroupOn and Netflix, but also at All-American stalwarts like American Express and Verizon. It has a 100% placement rate!

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\(^3\) See http://insightdatascience.com/
Akin to Ford Foundation’s social science-based reform of business education, forward-looking business schools are retooling on STEM foundations, elevating themselves to the new reality by launching MSBA programs. Indeed, a newly formed graduate program in Analytics (at the University of Cincinnati) has been designated a STEM program by the STEM Education Coalition. The adjoining figure illustrates this paradigm shift, which is driving the first of the three transformations facing businesses in knowledge economy.

The second transformative force is the need for blended managers who manage not only people, processes and resources (traditional MBAs), but also information assets and data-driven decisions (as businesses increasingly will rely upon). In other words, businesses want models plus managers, the former furnishing analysis/evidence from market data and the latter integrating insights/intuition to make profitable decisions.

Finally, the business community recognizes that the data → insight process is incomplete. To create enduring value, managers need to analyze the “right” data and extract the “right” insights.

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4 See https://business.uc.edu/graduate/msbana.html
To that end, data analyses need to be preceded by proper “problem formulation.” The insights resulting from data analyses should follow “effective articulation” in both written and oral formats to inspire actions. And the entire process from formulation → data → insight → action should be driven by “critical thinking” at every stage. We refer to this holistic process ↓ formulation, analysis, articulation, and critical thinking ↓ by the acronym FAACT. As the above figure shows, the three transformative forces act in concert.

1.3 Timetable for development

The MSBA program starts in Fall 2016 (Year 1) with an initial class of 40 students. It adds another cohort of 40 students in Year 3 (Fall 2018), thus expanding to 80 total students. Classes will be held in the GSM San Ramon campus during the time slots currently unutilized, e.g., Saturday evening (5 to 9 pm), Sunday (9 am to 6 pm), Weekdays (7 to 9 pm), and Online instructions.

1.4 Relation to campus academic plan

At the Davis campus, the Provost’s Data Science Initiative has been kicked off with Professor Duncan Temple-Lang as its Director. The MBSA program will actively engage and contribute with DSI to increase visibility of UC Davis. It provides a success story for DSI to showcase and gain external visibility and corporate connections, leading to new possibilities for endowments and grants. The success of MSBA program may even be replicated further into Healthcare Analytics and other areas.

New faculty hires in the MSBA program, with STEM and quantitative management science backgrounds, can create new graduate groups with interests in Big data, Dimension Reduction, and Data Visualization, thereby not only deepening scientific research at UC Davis, but also bridging industry ties to facilitate corporate funding and endowments.

1.5 Interrelationship with other University of California institutions

At present, no university in the UC system offers an MSBA program. UC Davis was the first in the UC system to offer a Business Analytics concentration in its MBA program since 2007. In
summer 2014, UCSD proposed an MSBA program, which is under review and the steering committee members of this proposal served as their external faculty reviewers. The University of Southern California plans to start its MSBA in 2015. Appendix C lists many universities across the nation that offer Master of Science degree in Business Analytics.

Some universities offer non-MSBA programs in analytics or data science that do not focus on business as the domain area. For example, UC Berkeley offers Master of Information & Data Science, which is an on-line working professionals program of the School of Information and not an MSBA program run through its Haas business school. University of San Francisco has also recently begun an 11-month master’s program in analytics with a distinctly technical flavor.

Consistent with McKinsey Global Institute report\(^5\), industry leaders perceive a substantial shortfall in the supply of analytically trained business professionals. For example, Dr. Don Dini and Dr. Rishiraj Pravahan, Principal Data Scientists at AT&T Foundry, wrote in their letter (see Appendix B), “we already feel the necessity for managers trained with the technical knowhow of data analytics and feel there are very few academic programs that address this demand.” Given this demand and supply gap, all of these programs are heavily oversubscribed. For instance, Northwestern University’s master’s program attracted 600 applications for 32 seats. Given the demand-supply imbalance, the issues of admissions or placements are not primary.

1.6 Departmentally-based graduate program

The MSBA program is organized primarily to establish and administer graduate business analytics education leading to the Master of Science degree, in conformance with the rules of the Graduate Council and the Office of Graduate Studies of the Davis Campus of the University of California. The MSBA shall be a departmentally-based program within the Graduate School of Management.

1.7 Program evaluation

The MSBA program will seek a STEM degree classification as per an appropriate CIP Code to

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be advised by Graduate Council and the Office of Graduate Studies. The faculty will be academically or professionally qualified to teach, conduct research, and render service, conforming to AACSB requirements and guidelines for accreditation. Because much of the leading-edge activity in business analytics takes place outside academia, we anticipate using part-time adjunct instructors with advanced degrees (e.g., Ph.D. in analytical fields).

Section 2. Program

The MSBA program targets professionals with an undergraduate degree in a quantitative field and build on their aptitude for statistics, mathematics, computer science, economics, or business. It admits both the full-time students (domestic and international) and working professionals with either part-time jobs or full-time jobs that treat program work as professional development time. The MSBA students will learn how to critically evaluate business opportunities and effectively translate data and techniques into business insights and value. They will gain experience in collecting and processing data, determining additional data collection needs, and creating statistical and decision models for business data (e.g., customer purchase behavior, web logs, social media activity, inventory and capacity history). Through the practicum, they will have successfully integrated decision models, data, and a user interface as a system to facilitate decision-making. An industry-sourced team project serves as the spinal cord to provide hands-on opportunity to learn analytical methods and concepts imparted in the classroom-based courses. The program aims to build competence in analytic methods, tools and application domains, as well as managerial effectiveness.

Appendix H presents the degree requirements in the format of the Graduate Council.

2.1 Undergraduate preparation

Applicants are expected to enter the program with an undergraduate degree in quantitative majors such as engineering, mathematics, statistics, econometrics, and other majors. No restrictions exists on any major, but applicants are expected to possess aptitude and appetite for quantitatively-oriented coursework and careers.

Successful applicants shall meet the UC Davis requirements for graduate admission. They will
hold a bachelor’s degree with at least a 3.00 grade point average. They provide two letters of recommendation, write a statement of purpose and personal history describing the applicant’s background, experiences, rationale for seeking the degree, and intentions for applying the newly-obtained knowledge and skills. They may be required to pass an interview after initial screening. GRE or GMAT or equivalent may be required.

Successful applicants will have completed coursework in three primary areas comparable to the following UCD courses:

**Computing and software engineering**

- **ECS 40:** Software Development and Object-Oriented Programming

- **ECS 60:** Data Structures and Programming
  Design and analysis of data structures for a variety of applications. Trees, heaps, searching, sorting, hashing, graphs. Extensive programming.

**Mathematics**

- **MAT 21A:** Calculus I

- **MAT 21B:** Calculus II
  Definition of definite integral, fundamental theorem of calculus, techniques of integration. Application to area, volume, arc length, average of a function, improper integral, surface of revolution.

- **MAT 21C:** Calculus III
  Sequences, series, tests for convergence, Taylor expansions. Vector algebra, vector calculus, scalar and vector fields. Partial derivatives, total differentials. Applications to
maximum and minimum problems in two or more variables. Applications to physical systems.

- MAT 22A: Linear Algebra
  Matrices and linear transformations, determinants, eigenvalues, eigenvectors, diagonalization, factorization.

### Statistics and probability

- STA 130A or 130 B or 141: Mathematical Statistics
  Basic probability, densities and distributions, Chebyshev’s inequality, some special distributions, sampling distributions, central limit theorem and law of large numbers, point estimation, interval estimation, confidence intervals, general linear model, least squares estimates, Gauss-Markov theorem, multiple regression. Computations to access, transform, explore, analyze data and produce results. Concepts and vocabulary of statistical/scientific computing.

- ECS 132: Probability and Statistical Modeling for Computer Science

Course work deficiencies should be made up by taking equivalent courses or equivalent online certification courses by the end of the first quarter by earning a letter grade of “B” or better.

To be admitted students must meet the following requirements:

- A completed Office of Graduate Studies application.
- An undergraduate degree from an accredited institution.
- A satisfactory undergraduate grade point average (minimum 3.0)
- A satisfactory performance on GMAT (typically 550 minimum) or GRE exam, although exceptions can be made based on grade point average, relevant work experience, or other criteria.
- A satisfactory performance on Test of English as a Foreign Language (TOEFL, IELTS or
PTE) exam for applicants whose primary language is not English or whose graduation is from a university at which the language of instruction was not English.

- A written exam and/or an interview (in person or video/audio call)
- A written statement of purpose and essays
- Two letters of recommendations

Based on recommendations of the admissions committee, some of the selected applicants may require a boot-camp review or online course certification to ensure their quantitative readiness to join the cohort.

### 2.2 Foreign language

There will be no foreign language requirement.

### 2.3 Program of study

#### a) Specific fields of emphasis

The MSBA aims to build competencies in:

- Analytics: core statistical and computational techniques (including data modeling and databases, regression and related statistical methods, data mining and machine learning, and operations research methods);
- Data: core methods for acquiring, storing, handling and representing data;
- Business: necessary skills for achieving organizational impact, including but not limited to leadership, strategic thinking, communication, and project management;
- Practice: key insights that can be gained only through hand-on experience working with and implementing analytical projects in a business environment.

Small teams of approximately four students each will tackle a data-driven project during the duration of the program. Student teams will learn analytics not just by absorbing methods and concepts imparted in class, but more critically, by navigating the complete project lifecycle on business problems drawn from industry. The journey from problem identification to analysis to insights and action will take place under the direction of program faculty.
b) Plan(s): Masters I and/or II

The MSBA program will follow Plan II. Students are required to complete all the required courses, including a comprehensive examination. See
http://academicsenate.ucdavis.edu/bylaws_and_regulations/regulations.cfm?#500-.

c) Unit requirements

The MSBA program offers 40 units of graduate courses, which includes a project equivalent of 10 credits of graduate course work over the ten months spanning Fall, Winter, and Spring quarters and ending in Summer Session 1.

d) Required and recommended courses

The MSBA curriculum is lock-step and all courses are required. Please see Sections 2.11 and Section 5 for course list and descriptions.

e) Description of examination element

The proposed MSBA follows Master’s Plan II. Please see Appendix H for details of degree requirements.

f) Licensing requirements

Certification or licensing is not a requirement for completion of the MSBA degree. Certified Analytics Professional (CAP) is a program from the Institute for Operations Research and Management Science (INFORMS) that tests knowledge across various stages of problem definition, data extraction and transformation, and model deployment and monitoring. A CAP-certified analyst is expected to tackle the challenges of a business analytics role in the real world. To this end, MSBA coursework will cover materials from the CAP syllabus to prepare graduates to pass the examination shortly after, or even before, graduation.
2.4 Field examinations

Not applicable.

2.5 Qualifying exams

Not applicable.

2.6 Thesis and/or dissertation

Not applicable.

2.7 Final examination

All students are required to take a written comprehensive examination once they have completed 30 units of graduate courses and 10 units of project work in Summer I. Fulfillment of the Comprehensive Examination is the last requirement of the M.S. Plan II. The scope of the written exam includes all the required courses in Fall, Winter and Spring Quarters. The examination will be evaluated by two reviewers, at least one of them must be a member of the GPC or MSBA program faculty with no direct vested interest in the success of the student (e.g., the student is not the reviewer’s GSR or co-author on the project).

Once passed, the Master’s Report Form is signed by the Graduate Adviser and then forwarded to the Office of Graduate Studies in accordance with the deadlines noted in the campus General Catalog (available online at the website of the Office of the Registrar). A student must maintain a GPA of 3.0 for the M.S. degree to be awarded. A candidate must be a registered student or in Filing Fee status at the time the program submits the form, with the exception of the summer period between the end of the Spring Quarter and the beginning of Fall Quarter. The program must file the report with Graduate Studies within one week of the end of the quarter in which the student’s degree will be conferred.

2.8 Explanation of special requirements

No special requirements above the normal university guidelines are expected.
2.9 Relationship of master’s and doctoral programs

The MSBA is a terminal degree.

2.10 Special preparation for careers in teaching

Not applicable.

2.11 Sample Program

The MSBA is a lockstep program with no electives. All students will take the courses as described below. The structured curriculum consists of the eight classroom-based courses and four guided practicum workshops are shown in the table below.
<table>
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<th>Fall</th>
<th>Winter</th>
<th>Spring</th>
<th>Summer 1</th>
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<tr>
<td>Business</td>
<td>BAX401 Intro to Business Analytics</td>
<td>BAX402 Organizational Issues in</td>
<td>BAX403 Organizational Effectiveness Workshop</td>
<td>BAX464: Practicum Implementation</td>
</tr>
<tr>
<td></td>
<td>(2 units)</td>
<td>Implementing Analytics</td>
<td>(2 units)</td>
<td>(4 units)</td>
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<tr>
<td></td>
<td>BAX411 Problem Structuring</td>
<td>BAX422 Big Data</td>
<td>BAX423 Data Design and Representation</td>
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<td></td>
<td>(2 units)</td>
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<tr>
<td>Data</td>
<td>BAX421 Data Management</td>
<td>BAX442 Advanced Statistics</td>
<td>BAX443 Analytic Decision Making</td>
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<tr>
<td></td>
<td>(2 units)</td>
<td>(3 units)</td>
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<tr>
<td></td>
<td>BAX431 Data Visualization</td>
<td>BAX452 Machine Learning</td>
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<td></td>
<td>(2 units)</td>
<td>(3 units)</td>
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<tr>
<td>Analytics</td>
<td>BAX441 Statistical Exploration and</td>
<td>BAX453 Application Domains</td>
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<td></td>
<td>Reasoning</td>
<td>(3 units)</td>
<td>(3 units)</td>
<td></td>
</tr>
<tr>
<td>Practice</td>
<td>BAX461 Practicum Initiation</td>
<td>BAX462 Practicum Elaboration</td>
<td>BAX463 Practicum Analysis</td>
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<td></td>
<td>(2 units)</td>
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</table>
2.12 Normative time to degree

The MSBA is a 10-month program. It starts in the Fall quarter and ends in Summer 1.

Section 3. Projected Need

Google’s chief economist and former UC Berkeley faculty, Dr. Hal Varian said in the Wall Street Journal (Data Crunchers Now the Cool Kids on Campus, March 1, 2013) that, “Data availability is going to continue to grow,” and “to make that data useful is a challenge. It’s generally going to require human beings to do it.” McKinsey Global Institute report estimates that by 2018 “the United States alone could face a shortage of 1.5 million managers and analysts with the know-how to use the analysis of big data to make effective decisions.”

According to the Chief Data Scientist of BAE Systems (see Appendix B) who reviewed our draft proposal, there is a “… growing need for trained professionals at the intersection of business and analytics.” Dr. Don Dini and Dr. Rishiraj Pravahan, Principal Data Scientists at AT&T Foundry, wrote in their letter (see Appendix B), “we already feel the necessity for managers trained with the technical knowhow of data analytics and feel there are very few academic programs that address this demand.” Likewise, Prof. Eric Rolland, Interim Dean, UC Merced, notes (see Appendix A) that “… California is a leader in terms of the analytics-related industries, and it is natural that the University of California would employ its resources in order to better serve its industry and its people. The solid backing that this proposal has garnered from outside the University is a clear message that the program is both attractive and much needed.”

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6 http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation
3.1 Student demand

All available data point to strong student interest in business analytics graduate programs. The evidence of demand comes from not only students’ expressed interests in the knowledge domain, but also the emergence of new programs in response to both students’ interests and employers’ desire to hire graduates from such programs. The data on students’ interest comes from the recent survey conducted by Rady Business School at the UC San Diego campus, which we will describe shortly. But more importantly, the figure below from the McKinsey report indicates severe shortage of analytical skills.

![Graph showing shortage of analytical talent](image)

**Demand for deep analytical talent in the U.S. could be 50-60% greater than its projected supply by 2018**

Consequently, students with undergraduates in mathematics, statistics, computer science, economics or business find analytics degrees attractive because of the following factors:

- Strong industry demand for analytical skills, which the McKinsey report\(^7\) estimated at **1.5 million managers in 2018**;
- High growth in industry demand ranging from 50% to 500% per annum\(^8\);
- Limited supply of analytics graduates, which equals a few thousand graduates annually based on graduating cohorts of 50 from at most 100 programs nationally;
- High **starting salaries in the range of $96,000 to 100,000** according to the benchmark study\(^9\) by North Carolina State University.

**UC San Diego Survey.** To justify demand for their proposed MSBA degree, Rady Business School conducted a survey in 2013-14, where students expressed strong interests in pursuing business analytic master’s degree. The survey was completed by students majoring in computer science, economics, management science, mathematics or physics to determine students’ demand for a MS degree in business analytics. Of the 252 students who responded to the questionnaire, approximately 82 percent were undergraduates and 18 percent were graduate students. Approximately 85 percent (215 students) indicated an interest in such a degree, with 61 percent (154 students) stating a desire to do so within 1-5 years.

**Other Universities.** Given that most programs are operational since last 1-3 years, data on applicant pool is not widely available. Nonetheless, the two year old analytics master program at the Northwestern University had 600 applications for 32 seats. University of Southern California received over 300 applications in their first year and expects to admit up to 50 students. According to media, The Massachusetts Institute of Technology also plans to launch a program with enrollment of 50 students.\(^10\) New York University’s Stern Business School launched their program in 2013. Mr. Roy Lee, assistant dean of global degree programs, says “he has filled both cohorts of 60 with ease. We closed out the admissions cycle a month and half early, with a

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\(^7\) [http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation](http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation)


\(^9\) [See http://analytics.ncsu.edu/reports/MSA_Benchmarks.pdf](http://analytics.ncsu.edu/reports/MSA_Benchmarks.pdf)

waiting list for the following year.” Similarly, NC State University’s analytics program admitted 80 students in Fall 2013, attained 100% placement rate, and 90% graduates had two or more job offers before graduation, with starting salaries ranging from $75,000 to $135,000.\textsuperscript{11}

**UC Davis.** To further assess demand, we hired two of our own graduated MBAs --- Aditi Raipet (MBA 2009) and Onyeka Enwerem (MBA 2014) --- to conduct not only market analysis, but also benchmark the courses and curricula across programs. Based on their research, the growth in analytics-related programs in the US has been nothing less than spectacular. About four new MSBA programs were launched every year in the past five years. Appendix C lists many universities offering MSBA degrees with their enrollments and fees. The median enrollment is 45 students and the mean enrollment is 50 students. The enrollment ranges from a low of 16 students at the University of Rochester with $63,000 fees to a high of 90 students at the Arizona State University with $31,300 fees. The median fees is about $1300 per unit, suggesting $52,000 fees for 40-unit degree program.

Consistent with these figures, the Rady Business School of UC San Diego proposes to enroll an average of 40 students with fees ranging from $52,900 to $59,800 in the first 5 years. Their proposal has been approved by the Graduate Council and Representative Assembly of UC San Diego. To maintain parity with UC San Diego’s program, we propose **40 students per year with $52,000 fees per student.**

In response to the demand and placement, Prof. Vincent Nijs from UCSD says, “The large number of supporting letters from companies is further evidence that neither student demand nor graduate placement will be a concern.” We next present further evidence on placement opportunities.

### 3.2 Opportunities for placements of graduates

Placement prospects for MSBA graduates are excellent. The Silicon Valley knowledge industry alone is capable of absorbing hundreds of trained Business Analytics professions each year.

\textsuperscript{11} \url{http://analytics.ncsu.edu/reports/MSA_Benchmarks.pdf}
Furthermore, data analytics is a high demand area in rapidly industrializing economies, and jobs in their home countries are becoming an increasingly attractive option for international students.

Most universities listed in Appendix C are 2-4 years young since the inception of their MSBA program, and hence they do not report placement data publicly. We do know that the North Carolina State University’s Master of Science in Analytics places 90%+ students prior to graduation. From a cohort of 81 graduates in 2013, 93% were placed by graduation; and of its 79 graduates in 2014, 100% were placed by graduation.

Prof. Michael Rappa, Director of Institute for Advanced Analytics at North Carolina State University (NSCU), conducted a benchmarking study (Dec 2014) on student outcomes. The following figures presents data on salary and placement outcomes from three different programs, Northwestern University, UT Austin, and NCSU. Needless to say, the opportunities for analytics graduate are excellent.

![Analytic Programs - Student Outcomes](image)

**Source:** Respective program web sites.
More generally, McKinsey estimates a shortage of 190,000 data scientists and 1.5 million managers possessing “proficiency in statistics to ask the right questions and consume the results of the analysis of big data effectively.” The deficit of qualified analytically-trained managers is estimated to be 7 times larger than the deficit of data scientists. In other words, the industry needs over a million (190,000 x 7) analytical managers who possess a specialized blend of skills in programming and database management, statistical analysis, and domain knowledge.

Similarly, the U.S. Bureau of Labor and Statistics expects management analyst jobs to grow at an average rate of 19 percent over the next decade. Prior growth in demand for “business analytics” jobs ranged from 50% to 500% as the adjoining figure from Indeed.com shows.

There is every reason to believe that MSBA graduates flowing into Silicon Valley’s growing knowledge industry will benefit from this hot job market.

Given the proximity of UC Davis to Silicon Valley, in particular because the MSBA is sited in the GSM’s San Ramon campus, many students are expected to be employed by the area’s rich information technology sector. The pedagogy is industry-agnostic. Graduates of MSBA program will be able to apply the analytical skills in organizations focusing on financial services, consumer products and heavy manufacturing, energy and renewables, health-care and life sciences, government, defense, and the nonprofit sector.

Corporate executives see promising opportunities for prospective graduates (see Appendix B). For instance, Mr. Scott Guckin from Kaiser Permanente wrote, “I am also excited about the San Ramon proximity to our IT operations in Pleasanton and I see potential for hiring opportunities when this program is up-and-running.” Similarly, Dr. Rajat Mukherjee, Head of Ecommerce, Yahoo Small Business, expressed strong support for “bringing in students with such skills into

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our group … as such analytical background and skills are often in short supply.” Dr. Harold Schmitz, Chief Science Officer at Mars Inc. wrote “… the proposed program content is solidly designed in terms of its mix of tools, techniques, and domain knowledge … We are pleased to offer support at this time … in hiring and placing graduates and in providing financial or other support for the most distinctive elements of this program.”

External faculty also corroborate these observations (see Appendix A). Prof. Terrence August of UCSD says, “Having this program, as designed, up and running would be an immediate success for both UC Davis GSM and bay area companies that have a demonstrated need for human resources with these important skill sets. Moreover, society will directly benefit in the future from new, improved, and even evolved products and services ...” Prof. Vincent Nijs from UCSD says, “The large number of supporting letters from companies is further evidence that neither student demand nor graduate placement will be a concern.”

3.3 Importance to the discipline

Business Analytics explicitly relates business performance to data, encompassing both diagnostic and prescriptive modes. It employs analytical tools from mathematics, operations research, statistics, machine learning, and information technology. The difference between Business Analytics and Data Science is that the former focuses on business performance rather than techniques or technology. Business Analytics marries tools and techniques from Data Science to the business goals of identifying business opportunities and creating business value.

The Institute for Operations Research and Management Science (INFORMS) serves as one of the prominent professional society of analytical methods for business decision-making. It has taken the lead in identifying analytics as the discipline that marries applications and techniques from its own traditional subjects such as optimization and simulation and data management and related topics from information technology to emerging topics of Big Data, visualization, machine learning, and automated knowledge management. INFORMS has created special interest groups, both in analytics itself and in analytics education. The latter, in particular, is among the highest activity sections of the Society because new programs are announced by universities in the US and elsewhere in this forum.
Consequently, this confluence of business and analytics facilitates the advancement of science and practice of the emerging business analytics discipline by bringing together faculty, students, and companies to promote research, teaching, and outreach. In addition, the proposed MSBA program, together with other related programs in the nation, accelerates the paradigm shift from social science based business education to STEM-based business education (see figure on page 5 and Section 1.2 for details).

3.4 Needs of society

A 2013 report by the McKinsey Global Institute estimated that business analytics on big data have the potential to increase annual GDP in retail and manufacturing by $325 billion and in health care and government services by $285 billion.\textsuperscript{13} To achieve this potential, the report says:

> Big data promises big things — but only if organizations have the right people in place who know what to do with it. A recurring theme among senior leadership across all sectors is a shortage of professionals trained and experienced at the intersection of disciplines necessary to capture, analyze, and generate meaningful business insights from big data. In addition to deep analytics talent, organizations need management with the right balance of business judgment and statistical skills to translate analysis into action.

Needless to say, the global competitiveness of the US businesses depend on the training and talent of our graduates. The MSBA program strives to contribute to the human capital and the analytics-trained management workforce of the 21st century.

3.5 Relationship to professional interests of the faculty

GSM faculty is actively engaged in business analytics research and teaching as well as professionally active in INFORMS and Marketing Science Societies. They co-author journal articles, host joint conferences, and attend seminars organized by other departments on UCD campus such as Mathematics, Statistics, and Economics departments. In addition, the MSBA

\textsuperscript{13} See http://www.mckinsey.com/insights/americas/us_game_changers
program opens up synergistic possibilities to engage in inter-disciplinary and collaborative activities with Data Science Initiative, enriching the ecosystem of UC Davis campus and creating new learning opportunities to undergraduate and graduate students. Besides inter-disciplinary collaborations, the MSBA program will provide opportunities for outreach with data-intensive companies in Silicon Valley and health care organizations in greater Sacramento area. Finally, given the intent to hire STEM-based faculty, the MSBA program will attract funding through grants and endowments.

3.6 Program differentiation

The MSBA program has three distinctive features that differentiates it from other programs.

First, due to its location in GSM’s San Ramon campus, the MSBA program’s proximity to Silicon Valley, which is the global epicenter of the analytics revolution, offers a competitive advantage relative to many other programs. This feature of being embedded in the ecosystem of analytic- and data-driven companies is hard to imitate for many other programs in the nation. It also helps in terms of student admissions and placements, availability of corporate projects, and participation of adjunct faculty or seminar speakers or donors. As Mr. Scott Guckin from Kaiser Permanente writes (see Appendix B), “I am also excited about the San Ramon proximity to our IT operations in Pleasanton and I see potential for hiring opportunities when this program is up-and-running.” Similarly, Prof. Vincent Nijs of UCSD writes, “The program will have access to a pool of student applicants and company recruiters in, what has been termed, the heart of the knowledge economy.” See Appendix A.

The second differentiating feature is the 10-month long project that runs in all quarters and that devotes 10 credits to a “real world” Business Analytics project. It accounts for 25% of the total credits hours. This depth of hands-on experience afforded to MSBA graduates --- to transform complex business problems into an analytic framework, collecting and analyzing data, gaining insights, and recommending actions --- is unparalleled across all extant programs, which offer a short stint at the end of all course work rather than immersive project-centered learning. Resonating with this project feature, Prof. Terrence August of UCSD states (see Appendix A), “The commitment of 25% of the curriculum dedicated to an ongoing, real world business analytics project is quite commendable. This aspect certainly stands out from other business
analytics programs and ... graduating students will have a competitive advantage in the marketplace.”

Finally, as explained in the figure on page 6, formulation of the business problem, articulation of insights and recommendations, and critical thinking in all stages of the project lifecycle are the key components of learning. The MSBA curriculum recognizes the importance of communicating analytics and that business analytics projects will fail if the leaders championing these projects do not possess the skill sets to influence others in their organizations. Hence the program devotes 10 units of course work, representing 25% of the total course work to the “Effectiveness” aspects (see Table in section 2.11). Many programs acknowledge this need, but do not allocate adequate resources to instill such values and develop those skills. This emphasis on “organizational effectiveness” in the curriculum is the third differentiating feature. Prof. Vincent Nijs concurs: “A consistent theme in conversations with companies is their inability to find qualified people in the area of Business Analytics. The required skill-set includes statistics, machine learning, etc. but also the ability to communicate complex analyses and insights effectively. The proposed program blends both the technical and the ‘soft’ skills in an excellent balance.” See Appendix A.

Section 4. Faculty

To launch MSBA program and manage the growth for GSM, many of the existing GSM faculty are willing to teach new courses on an overload basis. Overload teaching will end three years following the program launch. During that time, we plan to hire a total of five full-time ladder rank faculty to shepherd the MSBA program successfully. Below, we present the abbreviated CVs of the faculty who expressed interest in participating in the MSBA program, their areas of expertise, and recent publications.

We have discussed the program with related departments (Statistics, Mathematics, and Computer Science) and welcome participation from interested faculty, subject to meeting program needs and administrative requirements.
Summary of Faculty Qualifications

ASHWIN ARAVINDAKSHAN, Ph.D.

Assistant Professor of Management

Areas of expertise: Assistant Professor Aravindakshan’s research interests center on learning how brands can better allocate their advertising resources (e.g. budgets, creatives, etc.) across different regions and/or multiple media over time. In addition to studying such dynamic advertising models his research also investigates the dynamics of customer behavior and loyalty to help managers devise better communication and targeting policies in order to optimize their marketing mix at the individual level.

Recent Publications


Prof. Aravindakshan is qualified to teach MBX261, MBX263 and mentor project teams.

HEMANT BHARGAVA, Ph.D.

Jerome & Elsie Suran Chair and Professor of Technology Management

Areas of expertise: Professor Bhargava’s research examines business strategies for producers of technology goods, especially involving operations, marketing and monetization issues when products have network effects and platform characteristics. He has also studied processes and techniques related to model-based decision making, and development of information technology solutions to facilitate use of models and data in decision making.
Recent Publications


In addition to co-directing the MSBA program, Prof. Bhargava is qualified to teach BAX201, BAX203, BAX226 and BAX241 and mentor project teams.

RACHEL CHEN, Ph.D.

Associate Professor of Management

**Areas of expertise:** Associate Professor Chen is an expert in operations research and supply chain management. She has studied operations in service industries, including airlines and health care.

Recent Publications

- Chen, Rachel, and Lawrence W. Robinson. (2012) “Optimal Multiple-breakpoint Quantity Discount Schedules for Customers with Heterogeneous Demands: All-unit or


*In addition to co-directing the MSBA program, Prof. Naik is qualified to teach MBX201, MBX203, MBX228, MBX263 and mentor project teams.*

Olivier Rubel, Ph.D.

Assistant Professor of Management

Areas of expertise: Assistant Professor Rubel focuses on traditional media advertising, digital marketing and dynamic pricing. He develops new analytical and empirical methods to
dynamically optimize returns on marketing investments. He is interested in health care and technology and durable goods markets. His research appeared in leading journals and has been presented to companies and at international conferences.

**Recent Publications**


*Prof. Rubel is qualified to teach MBX261, MBX263 and mentor project teams.*

**SANJAY SAIGAL, Ph.D.**

Visiting Assistant Professor

**Areas of expertise:** Dr. Saigal is currently a visiting assistant professor at GSM, making key contributions to the development of the MSBA proposal. He has taught management science and supply chain management in all three of GSM’s MBA programs since 2009. Concurrently, he consults in supply chain analytics and decision management with analytics leaders and with traditional businesses, in the US and abroad.

*Dr. Saigal is qualified to teach BAX201, BAX203, BAX205 and BAX226 and mentor project teams.*
CHIH-LING TSAI, Ph.D.

Distinguished Professor of Management

Areas of expertise: Professor Tsai is a recognized expert in the practical application of statistics in business, including regression analysis, model selection, high-dimensional data, time series and biostatistics. He has had more than 100 research papers published in academic journals relating to statistics, marketing, finance and biostatistics. He teaches courses on forecasting and managerial research methods, and time series analysis and forecasting.

Recent Publications


DAVID WOODRUFF, Ph.D.

Professor of Management

Areas of expertise: Professor Woodruff’s research concerns computational aspects of optimal decision making. He is particularly interested in problems with a mix of discrete and continuous choices with multiple time stages when there is significant uncertainty. His research includes solution algorithms, problem representation and modeling language support. He has worked on applications in operations, logistics, science, and has been involved in a number of applications in electrical energy planning and scheduling.

Recent Publications

Prof. Woodruff is qualified to teach BAX226 and BAX228.

Catherine Yang, Ph.D.

Associate Professor of Management

Areas of expertise: Associate Professor Yang focuses her research in the field of data mining, including web mining, market segmentation, predictive modeling, Internet marketing and formal modeling in e-commerce. She is interested in developing a way to better integrate data mining and Internet marketing to analyze consumer behavior, giving companies tools to make better choices for committing revenue streams to personalized and targeted advertising and marketing.

Recent Publications


Prof. Yang is qualified to teach BAX241 and BAX263.
Section 5. Courses

Using the market analysis study conducted by our MBA graduates (Ms. Aditi and Onyeka), we reviewed all the syllabi of every course offered by the MSBA programs listed in Appendix C. Then we grouped the topics, tools, techniques, concepts, and frameworks that were shared by most and synthesized them to create the following set of courses. All courses are new and required by all students in the lock-step MSBA curriculum. A brief description of courses appear below, stating the number of units, quarters in which they will be taught, the classification into four streams (business, data, analytics, practice), the modes of delivery, and the content.

BAX401 Introduction to Business Analytics

Units: 2
Quarter: Fall
Stream: Business
Mode: Hybrid learning (lecture/case discussion)

Description. Broad overview of subject with emphasis on strategic business value. Introduces business analytics concepts through case studies covering process improvement, prediction, operations and supply chain management, multi-criteria and group decision-making, and Big Data applications in marketing and logistics. The focus is on real-world realization of business value by transforming raw data into sophisticated insight through a well-defined business analytics process, and only secondarily on tools and techniques.

BAX402 Organizational Issues in Implementing Analytics

Units: 2
Quarter: Winter
Stream: Business
Mode: Hybrid learning (lecture/case discussion)

Description: Organizational challenges specific to deploying business analytics to non-quantitative colleagues through IT. The evolving role of analysts within organizations. Skills required to assemble and manage teams with the right analytics skills. The decision analytic life-
cycle: working through an operational problem from identification to value delivery including managing organizational change. Communicating analytics, interpreting data, estimating and capturing ROI, creating dashboards, presenting recommendations, discussing statistical and computational techniques.

**BAX403 Implementation Effectiveness Workshop**

*Units: 2*

*Quarter: Spring*

*Stream: Business*

*Mode: Lecture, text/readings, workshop, guest speakers*

*Description:* Intensive skill-oriented workshop covering analytic leadership and effective communication. Project management in rapid clock-cycle environments. The business analytics consulting environment. Security, responsibility, privacy and ethical implications of business analytics.

**BAX411 Problem Structuring**

*Units: 2*

*Quarter: Fall*

*Stream: Business*

*Mode: Hybrid learning (lecture/case discussion)*

*Description:* Overview of vocabulary, concepts and methods for mapping business problems into an analytical framework. Specific topics include influence diagrams, modelling uncertainty, dealing with multiple objectives, and consensus building.

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14 We next plan to scrape the web for terms used by employers in job ads and employees in their resumes to discover tools and techniques that the MSBA graduates must know to complement the curriculum.
**BAX421 Data Management**

*Units: 2*

*Quarter: Fall*

*Stream: Data*

*Mode: Lecture, text/readings, data lab exercises*

*Description: Acquiring, preparing and staging data. Specific topics include extract-transform-load (ETL), multi-dimensional databases and online analytical processing (OLAP), data warehousing, SQL, and nonrelational data (NoSQL, multi-media, streaming, networks, text search).*

**BAX422 Big Data**

*Units: 2*

*Quarter: Winter*

*Stream: Data*

*Mode: Lecture, text/readings, data lab exercises*

*Description: Big Data implementation tools: using Hadoop and similar databases, distributed computing, and tools such as MapReduce, Mahout, Pig and Hive, etc. Techniques for dealing with streaming data, network data, cloud computing, and data storage.*

**BAX423 Data Design and Representation**

*Units: 2*

*Quarter: Spring*

*Stream: Data*

*Mode: Lecture, text/readings, data lab exercises*

*Description: Computational reasoning about data representations. Topics include mapping conceptual data model to a relational structure, database architectures, and design tradeoffs.*
**BAX431 Data Visualization**

*Units:* 2  
*Quarter:* Fall  
*Stream:* Data  
*Mode:* Lecture, text/readings, data lab exercises  
*Description:* Techniques for data visualization, using diverse tools to refine data and create visualizations, such as Python, ManyEyes, HTML/CSS, D3.js, and Google Charts. Topics include standard visualization formats (histograms, boxplots, dashboards), and specialized formats (3D, animation, wordclouds, treemapping, dendograms, audio streaming).

**BAX441 Statistical Exploration and Reasoning**

*Units:* 2  
*Quarter:* Fall  
*Stream:* Analytics  
*Mode:* Lecture, text/readings, exercises  
*Description:* Obtaining preliminary insights and forming initial hypotheses through exploratory data analysis (EDA). Topics include descriptive statistics, critical statistical thinking, sampling, probability, and basic statistical methods (e.g. OLS).

**BAX442 Advanced Statistics**

*Units:* 3  
*Quarter:* Winter  
*Stream:* Analytics  
*Mode:* Lecture, text/readings, exercises  
*Description:* This class covers advanced statistical methods including maximum likelihood estimation (MLE), Bayesian models, nonparametric models, Monte Carlo Markov chain (MCMC), time series analysis, prediction, model specification, model selection, forecasting, and dimension reduction.
**BAX443 Analytic Decision-Making**

*Units: 3*

*Quarter: Spring*

*Stream: Analytics*

*Mode: Lecture, text/readings, exercises*

*Description: Decision-making frameworks (utility theory, decision trees, influence diagrams) and advanced techniques (Monte Carlo simulation, heuristics, and mathematical optimization). Hands-on exposure to advanced techniques through spreadsheets and other modelling tools. Discussion of Enterprise applications developed using simulation and optimization languages, and optimization engines.*

**BAX452 Machine Learning**

*Units: 3*

*Quarter: Winter*

*Stream: Analytics*

*Mode: Lecture, text/readings, exercises*

*Description: Construction of algorithms for learning from data, and the process for deriving business intelligence. Topics include supervised and unsupervised learning, reinforced learning, automated neural networks (ANN), scalable and parallel algorithms, clustering and dimension reduction.*

**BAX453 Application Domains**

*Units: 3*

*Quarter: Spring*

*Stream: Analytics*

*Mode: Lecture, text/readings, data lab exercises, guest speakers*

*Description: This course covers contemporary and emerging domains for high-yield applications of analytics. Examples include social network analytics, search analytics, health care analytics, internet of things (IOT), supply chain and operations analytics, and marketing analytics.*
**BAX461 Practicum Initiation**

*Units:* 2  
*Quarter:* Fall  
*Stream:* Practice

*Mode:* Experiential learning, data lab, group work, making and critiquing presentations

*Description:* Team formation and dynamics, problem framing, client engagement. Team project initiation with focus on requirements analysis, data discovery, documentation, and expectation-setting.

**BAX462 Practicum Elaboration**

*Units:* 2  
*Quarter:* Winter  
*Stream:* Practice

*Mode:* Experiential learning, data lab, group work, making and critiquing presentations

*Description:* Problem definition, data management, client engagement, data extract/transform/load (ETL), preliminary analysis.

**BAX463 Practicum Analysis**

*Units:* 2  
*Quarter:* Spring  
*Stream:* Practice

*Mode:* Experiential learning, data lab, group work, making and critiquing presentations

*Description:* Analytic insight, business value, client engagement, statistical and technical analysis. Value realization. Client communication.

**BAX464 Practicum Implementation**

*Units:* 4  
*Quarter:* Summer Session I  
*Stream:* Practice

*Mode:* Experiential learning, data lab, group work, making and critiquing presentations

*Description:* Finish analysis, identify business value, communicate value to client, and describe deployment process. This course culminates in a project presentation, preferably including representation from the client organization.
Section 6. Resource Requirements

The MSBA program is designed to be self-funded (SSDP). Appendix D presents the Budget. It shows the detailed items for expenditures (salaries, overload expense, benefits and other operating expenses) and revenues. The tuition is about $52,000 per student, which is similar to other MSBA programs in the US and is comparable to the UCSD’s proposed MSBA program. Year 1 revenues are expected to exceed 2.11 million; enrollment doubles in Year 3, due to two sections of 40 students each given the available classroom sizes in GSM San Ramon campus, resulting in the revenues of $4.47 million. To bootstrap the launch of this program, current GSM faculty, qualified faculty from other departments at UC Davis, adjunct faculty from other universities and company executive with advanced degrees will teach on an overload basis until one executive director and five new faculty are hired. The budget includes funds to cover this overload teaching and other expenses for visiting faculty, teaching assistants, staff support, as well as the long-term benefits for staff and faculty. Year 1 revenues exceed all program costs by 11.2%; in steady state from Year 3 onwards, the surplus ranges from 8.82% to 10.75%. Thus, the program is self-funded by student fees and uses no state funds.

6.1 FTE faculty

Faculty salaries will be funded directly from the revenues of the MSBA program. Appendix D presents the budget spreadsheet, which provides for the ongoing costs of five full-time ladder rank faculty focusing on the MSBA program. It also includes costs for research and travel support, summer support for two months, and long-term benefits.

6.2 Library acquisition

We do not anticipate any additional library resources. Library services required by the GSM includes adequate access to various research collections. This plan optimizes the “anytime, anywhere” concept of access to digital resources while maintaining convenient access to print materials.
Students and faculty will have convenient access to the subjects covered in the MSBA curriculum, including print and electronic resources. Current service provided to MBA and MPAC students will be extended to include the MSBA students as well. Resources needed for research by our faculty are currently in place and are not expected to expand with the addition of the MSBA program.

6.3 Computing costs

Appendix D includes computing costs to support the needs of MSBA students, faculty, and staff. The budget provides for a staff FTE of 0.50 for level III IT programmer in the first two years, which increases to 1.0 staff FTE for Year 3 and beyond. To maintain high quality computing environment, a budget of $200,000 in Year 1 and another $200,000 in Year 3 are earmarked for new capital expenses for IT support in MSBA program. Furthermore, based on 2013-14 GSM budget of per student IT costs, a budget of $25,840 per year in each of the first two years and $51,680 per year for Year 3 and beyond are factored as cost for ongoing computing support. The budget provides for computing costs over and above the standard costs incurred by the GSM for students in other programs.

6.4 Equipment

The budget provides for “analytics software and continuous program innovation” for both faculty and students. These line items include activities normally conducted by “centers” of business analytics such as organizing or attend special events or conferences, travel, new software development or assessments, faculty and students’ interactions with other invited visiting scholars and company executives, among others. Using the GSM budget for 2013-14 pro-rated per student and providing 66% more for the MSBA program due to its unique curriculum, the budget provides $84,000 for students ($50,000 for faculty) in each of the first two years and $168,000 per year ($100,000 for faculty) from Year 3 onwards. Besides the activities described here and under computing costs, no additional equipment costs are expected.

6.5 Space and other capital facilities

MSBA classes will meet in the GSM’s Silicon Valley Campus in San Ramon, either on weekday evenings, Saturday evenings, and all day on Sundays. These time slots are currently unutilized,
and thus the MSBA program improves asset utilization of these facilities. Due to the intensive use of data laboratory and team projects, the facility will be available for use by MSBA students all days from Sunday through Thursday. The budget provides for the lease costs of these facilities; $75,000 per year in first two years and $115,000 from Year 3 onwards. Note that the lease cost is already being incurred to run the MBA program in these facilities and, hence it is not an incremental cost (i.e., cash expenditures) resulting from the launch of the MSBA program. Nonetheless, the lease cost is being budgeted for in the spirit of “contributing” to the existing GSM operations.

6.6 Other operating costs

Executive Director

Under the guidance of program co-chairs, Professors Bhargava and Naik, the operating responsibility for the MSBA program shall lie with the Executive Director. This person shall coordinate with other GSM staff for operational purposes, and with industry partners for advising and recruiting. The appointee is expected to bring strong links within the knowledge industries in Northern California and beyond, as well as professional experience in Business Analytics.

Since the Executive Director is also anticipated to instruct and mentor MSBA students, she or he will need a strong academic foundation, such as an earned doctorate in an analytic discipline. As required by Academic Senate Graduate Council (letter dated May 27, 2015), the Executive Director will need to hold an academic title. The budget provides for full-time 100% FTE from Year 1 onwards. In addition, to bootstrap the launch of the MSBA program by initiating the network of corporate relations, soliciting the projects for students to conduct from Fall 2016, this position needs to be hired at least 6 months in advance. The budget provides for a 50% FTE as “pre-launch costs” in Year 0 (2015-16).

Staff FTEs

The MSBA effort will leverage existing GSM teams for marketing, student recruiting, career counseling, program development and fund-raising, and other administrative functions. In addition, the MSBA program will require dedicated personnel, as described below, to offer world-class learning experience and top placements for students. The support staff will manage the day-to-day program administration, student affairs, instructional support, project acquisition and implementation, marketing and business office services.
Specifically, based on consultation and feedback with the Senior Management Team at the GSM (see Appendix F for details), the budget explicitly provides for new staff FTEs as follows:

- Academic Operations (Analyst I, 0.25 FTE in Years 1 & 2, 0.5 FTE Year 3 onwards)
- Business Office (Analyst I, 0.25 FTE in Years 1 & 2, 0.5 FTE Year 3 onwards),
- Marketing (Analyst II, 0.25 FTE in Years 1 & 2, 0.5 FTE Year 3 onwards),
- Student Affairs (cross functional, 0.6 FTE),
- Student Affairs (Admissions and Recruitment, 1.0 FTE),
- Instructional (Analyst I, 1.0 FTE),
- Development (Associate Director, 0.1 FTE of existing staff)
- Analyst 4 (Corporate/Project Coordinator, 1.0 FTE for student projects acquisition)

A total of 4.45 FTEs for Years 1 & 2 plus a 0.5 FTE for IT programmer (see section 6.3) results in 4.95 staff FTEs. In Year 3 and beyond, including 1.0 FTE of the IT programmer mention in section 6.3, the staff FTEs increase to 6.20 FTEs. The budget in Appendix D incorporates the cost of staff FTEs, allows for 3% annual increase, and incorporates their long-term benefits.

By Year 3, the staff-to-student ratio is $\frac{6.20}{80} = 7.75\%$. The ratio is not high because, first, the two positions —Executive Director and Project Coordinator— are necessitated by the unique program characteristics: it is strongly industry-facing and it emphasizes project-based learning (a hands-on real-world project that runs the entire length of the program). While projects have an academic side, they also place a large administrative workload. Corporate relations have to be created and managed; projects have to be identified, acquired, scoped out, and then data need to be acquired and managed (e.g., non-disclosure agreements, privacy issues). These roles will be covered by a full time Projects director, and also will require time from the Executive Director. So these two positions may not exist for other programs. Second, additional staff support is needed during the execution of project (e.g., scheduling group meetings with clients). A dedicated staff person, listed here as “Student Affairs (cross functional)” and who will also serve a number of student-related needs, will provide such a support. Thirdly, besides these three FTEs, we provide 3.2 additional FTEs, after consultation with the GSM administration, to not free ride on existing GSM resources. Hence these positions augment GSM staff in Academic Operations, Business Office, Marketing, and Instructional Support.
However, as we launch and operate the MSBA program and realize we need fewer staff members to handle the load, we can indeed manage that over time. We do not expect to fill all these staff positions in Year 1 and 2, and we will evaluate staffing needs in Year 3. If we decide to not hire 3.2 FTEs (or any other cuts), the resulting savings in resources will be re-invested in student scholarships and faculty FTEs to recruit better students and enhance program quality. Finally, the MSBA staff-to-student ratio at 7.75% is substantially smaller than that for GSM, which operates with 55 staff FTEs for about 500 students (about 11%).

**Teaching Assistants**

The program budget covers the costs of two TAs at 25% appointment for fall, winter and spring quarters and includes the cost of fee remission (see Appendix D). Such a support is necessary for MSBA students and faculty to ensure quality and success in this rigorous program. Their roles are expected be similar to those used in the MBA programs, such as performing course administration, grading, data laboratory, and related tasks to assist students and faculty.

Depending on the financial success of the program, additional research and/or teaching assistants will be recruited. They are likely to be doctoral students or post-doctoral graduates in STEM disciplines or quantitative backgrounds (e.g., marketing, econometrics). They will assist the students to implement the projects and/or faculty to acquire/assess future projects.

**Student admissions and recruiting**

Students interested in the program will apply for admission via the Office of Graduate Studies on-line admission application. The GSM has a team of professional recruitment and admissions officers to assist applicants with their exploration of graduate programs and negotiation of the application process. Additional staff FTEs are budgeted for as described above under “Staff FTEs.” Program faculty will review applications using the on-line Graduate Application Review Database (GARD) and will recommend applicants for admission. The official admission offers will be issued by the Office of Graduate Studies. Applicants will accept offers of admission on-line via the Office of Graduate Studies. All students will be registered and enrolled through the Office of Graduate Studies.
Academic Advising

Support activities will begin via the Admitted Students Intranet prior to the students starting the program and are continued on a regular schedule throughout the program.

The GSM provides academic advising and assistance to students in the Graduate Student Services area. Graduate academic advisors provide incoming students with a comprehensive orientation to academic requirements and policies and then are in regular contact with students regarding academic matters. The graduate academic advisors ensure appropriate course enrollment, monitor academic performance and provide guidance on course selection. They also ensure that students with disabilities receive appropriate assistance and accommodation. Graduate academic advisors also serve as resources for students experiencing academic or personal difficulty, providing guidance and referrals to other services at GSM or elsewhere on campus.

The resources available for out of class assistance with course material and assignments include discussion groups run by faculty and teaching assistants and access to faculty and teaching assistants by e-mail or in person and at the offices. Additional staff FTEs and TAs are budgeted for as described above under “Staff FTEs” and “Teaching Assistants.”

Meals
The San Ramon campus provides meals to all students when the class time takes 6 hours or more per day. The cost of meals are based on current meal costs for San Ramon MBA students (about $1500 per student/year).

Remedial Courses and Advance Work
Remedial courses will be provide to students who need extra assistance. In addition, students will be encouraged to take online courses on advanced topics during the summer quarter before the classes start. Based on current GSM practice, the cost of Quantitative Fundamentals instructor, $100 per student materials cost, and 10% indirect cost adds up to $10,500 per year. The budget covers for such costs and allows for 3% inflation over time.
Marketing Costs
The budget provides for marketing costs to successfully publicize the program and build awareness among prospective students and potential employers. To this end, the budget provides for $100,000 per year for the first three years. In addition, it allows for ongoing costs of $40,080 for the first two years and doubles to $96,160 from Year 3 onwards. See Appendix D.

Campus Costs
The budget in Appendix D also incorporates the costs to the university for SSDP assessment (1.5% of revenues), Graduate Studies ($1000), and UCOP tax of 1.55% of prior year expenses.

Year 0 Costs
Finally, to be able to launch the program successfully, a few critical activities need to be initiated in Year 0 (i.e., 2015-16) prior to the start of the program in Fall 2016. These activities includes 50% appointment of an Executive Director, a full time staff in admissions and recruitment, 50% staff for corporate and project coordinator to acquire high-quality projects from companies. The total costs of such activities add up to $376,827. These funds need to be provided from campus/GSM and can be viewed as a “loan” that can be paid back from the net income generated in the subsequent five years.

Section 7. Graduate Student Support

7.1 Return to Aid, Awards, and Fellowships
Since the program will be located in the GSM’s San Ramon campus, the majority of MSBA students are expected to be full-time or part-time working professionals, who are either self-funded or funded by their employers. Some domestic and international students may need financial assistance. To this end, a portion of the generated fees will be reserved for financial aid on need or merit basis. Comparable to the UCSD’s MSBA program, the budget plans to set aside 5% of fees for scholarships; see Appendix D.
Awards will be made at any point during the admissions cycle. Once the program is approved, private donations will be solicited to help fund additional fellowships and awards for meritorious students.

Low cost government Stafford and Grad Plus loans are available to US Citizens and Permanent Residents. Stafford loans are available up to $20,500 per year, and Grad Plus and private loans are available for amounts in excess of $20,500. International students with a US co-signer, may be eligible for private loans.

7.2 Loan Repayment and Scholarships

There are several ways that MSBA graduates can repay debt similar to the current MBA or MPAC graduates, and they will not face additional financial hardships.

7.3 Underrepresented Students

The UC Davis GSM has a long history of successfully recruiting and admitting students from underrepresented groups. The MSBA program will continue to apply strategies used in the past, for example, attending professional conferences focusing on diverse populations. The marketing will be via the web site, collateral material, the listserv, informational sessions, one-on-one conversations with prospective students, referrals from alumni, and corporate connections.

7.4 Additional Financial Aid Programs

Not applicable.

Section 8. Governance

Appendix G presents the Bylaws for the governance of the MSBA program.

The Graduate School of Management will administer the program. Applications to the program will be managed by the Office of Graduate Studies. The Master of Science degree will be
awarded by the Office of Graduate Studies. Professors Bhargava and Naik are willing to serve as program co-chairs to kick off the program. Responsibility for the academic advising of students and access to student and faculty services will be centered in the GSM. Program review will be conducted by the Graduate Council following its normal procedures.

Administrative and student support services, such as program marketing, financial management, and faculty support, will be provided by the GSM. As discussed in Resource requirements, student academic and career advising along with student support services will be provided by GSM to ensure that MSBA students are integrated with the rest of the GSM student body and benefit from the school’s infrastructure. Fees from the MSBA students will finance these function so that it does not impact the support provided to GSM MBA students.

Financial management involves setting program fees, planning a budget, monitoring actual vs. projected income, monitoring expenditures, reporting to campus and OP budget and audit offices, and negotiating fee discounts.

Faculty services will be handled directly by the GSM as done currently with the MPAC program. This function involves arranging access to instructional facilities, scheduling course meetings, ordering textbooks and obtaining audiovisual materials, and administering class evaluations and grade reports.

Section 9. Changes in Senate Regulations

No changes are required.
Appendix A

Letters from External Faculty
Professor Hemant Bhargava and Prasad Naik  
Graduate School of Management  
University of California, Davis  
One Shields Avenue,  
Davis, CA 95616  

January 2, 2015

Dear Professor Bhargava and Naik,

Thank you for inviting me to provide an external review of the proposed Master of Science in Business Analytics degree program at UC Davis GSM. I enjoyed reading the formal proposal that was sent to me and found it to be very well-crafted.

For some background information on the perspective conveyed in my review, I am currently a co-chair (along with Professor Vincent Nijs) of the proposed Master of Science in Business Analytics degree program at UC San Diego, Rady School of Management. Together, we wrote the proposal submitted recently by UC San Diego. I have also been closely involved with organizing Rady’s Center for Business Analytics, and reaching out to corporate partners to identify how both our degree program and research center can help fulfill their expansive, unmet needs in the area of business analytics.  

Professionally, for almost two decades, I have been working with a number of companies including Clorox, Honeywell, GlaxoSmithKline, and Time Warner Cable to design and implement decision support systems to enable improved decision making within their respective organizations.

Before getting into the details of my review, I would like to start with the bottom line: This is an excellent proposal for a highly impactful degree program. Having this program, as designed, up and running would be an immediate success for both UC Davis GSM and bay area companies that have a demonstrated need for human resources with these important skill sets. Moreover, society will directly benefit in the future from new, improved, and even evolved products and services that result as business analytics becomes increasingly leveraged by the marketing, finance and operations functions of firms. Further, business analytics will drive more appropriate and cost-efficient investment decisions by firms which have the potential to generate substantial cost savings that can be passed on to consumers.

In the following, I will address each of the points of concern to CCGA. I believe the proposal makes a quite compelling argument that demand for this program will be very strong. As has been seen recently in industry, there is a high demand for data scientists who can make inferences from the vast amount of information collected by companies. However, there is an even greater demand for managers who are well-versed at identifying business opportunities, generating business insights, and developing business solutions. A manager who understands how business analytics can create business value within organizations serves an arguably even more important and strategic role. McKinsey’s report clearly corroborates this view. Notably, the evidence that is available from schools with existing M.S. programs
in business analytics also suggests both a significant applicant pool exists and strong placement results are likely. From my own interactions with leaders in companies with a San Diego presence and visionaries such as Dr. Larry Smarr, the founding director of the California Institute for Telecommunications and Information Technology, they commonly view analytics as a linchpin of the future enterprise. With the appealing density of technology companies located in the bay area, I expect that their need to leverage analytics to remain competitive will drive an increasing demand pool that will support UC Davis GSM’s projected 40 student initial class size and doubling to 80 students in year 3.

The program as proposed is a very cohesive one that focuses on working professionals and grounds their entire education in business needs and the added value derived from business analytics. I really like the program design and the integrated approach being taken. The commitment of 25% of the curriculum dedicated to an ongoing, real world business analytics project is quite commendable. This aspect certainly stands out from other business analytics programs and will give UC Davis GSM’s students a rich experience in taking a project through a complete lifecycle. At Rady, innovation is a focal point of our MBA program, and we also commit a 3-quarter series of courses called Lab to Market to the core curriculum. Such a commitment is a differentiator and makes a tremendous difference in our MBA program outputs; our graduates have started over 70 companies in the Rady School’s short 10 year existence. In the same vein, I believe this proposal’s commitment to a 10 month immersion project will be a differentiator and that graduating students will have a competitive advantage in the marketplace. These graduates will have a thorough understanding of how to define and lead business analytics initiatives. Beyond the practicum courses, I found the other set of courses to be a very solid foundation for business analytics. Of particular importance, I believe the inclusion of BAX203 (Dynamics of the analytic organization) to be a very wise and important inclusion, perhaps not surprising as the chairs of this proposal have been offering a business analytics MBA concentration since 2010 and are experts in this area. What I like about this course is that it elevates the importance of communicating analytics, handling organizational challenges, and dealing with change (instantiating new ways of doing business). Business analytics projects will fail miserably if the leaders championing these projects do not possess the skill sets to educate and influence others in their respective organizations. I was also very happy to see BAX241 (Managing data for insight) as sometimes the fact that data is dirty can be easily overlooked. It is clear that the program chairs of have carefully constructed a rigorous program that will graduate successful leaders who can spearhead business analytics initiatives.

Having taken a close look at the faculty profiles, it is also clear that UC Davis GSM has strong faculty representation that is more than capable of teaching the curriculum laid out in the proposal. Teaching the program initially in an overload state makes a lot of sense as the school will need time to find qualified faculty members that they want to hire. A short-run goal of 2 faculty FTEs and a long-run goal of 5 faculty FTEs is on target to adequately cover the required units, together with teaching support from an executive director and lecturers. Teaching this program at the San Ramon campus is also a good decision due to its close proximity to the companies that will likely supply the working professional students. While Saturday evenings and Sundays are currently underutilized at this facility, I do have reservations on whether students are very open to these times. This is probably worth investigating as the program moves forward. The budget sent with the proposal seems reasonable to me.

There are two areas that stood out to me as worth thinking about as the program chairs look to strengthen the degree program. First, all courses are required to be taken by all students due to the lockstep curriculum design. In itself, this seems like a perfectly reasonable thing to do and keeps each student cohort progressing through the program together as a batch. However, this can still be achieved while simultaneously building more flexibility into the curriculum design. For a simplified example, there could be a set of courses that the program chairs feel are equally as valuable to students as BAX261 (Network analytics), but cannot be included because of the 40 credit design. One possibility is
to list all of these courses as “elective” courses, but only offer one of them in a given year. For all practical purposes, the course that gets offered in a given year is essentially required to be taken, but the school gains more flexibility in choosing what to offer in any given year subject to faculty constraints. Further, the role of business analytics is evolving quickly, and it may be the case that what becomes revealed as being more useful to business analytics graduates changes. In this case, preference over this set of equally valuable electives may change and can inform the choice of what gets offered.

Second, the proposal indicates that successful applicants will have already completed extensive coursework in computing and software engineering, mathematics, and statistics and probability. Of particular importance are two courses under the latter category: MGX 203A (Data Analysis for Managers) and MGX 203B (Forecasting and Managerial Research Methods). The curriculum essentially requires that admitted students will have a sufficiently strong understanding of the content of these two courses. Having taught the MGT 403 (Quantitative Analysis) here at Rady School of Management in our Flex program (evening and weekend students with professional experience), my prior belief is that many students will not have a strong enough working knowledge of this material to hit the ground running in BAX261 (Network Analytics). While the raw material for a business analytics degree program will certainly vary from the MBA degree program, my sense is that it will pay dividends to have a well thought out mechanism to ensure that admitted students have sufficient time and resources to develop these competencies beforehand (perhaps an online class with videos that they work through with deliverables during the preceding summer or some other alternative).

In summary, I believe that the MSBA program as laid out in this proposal is a very promising endeavor for UC Davis GSM. It is a well thought out, high quality, and carefully structured degree program. It is also timely and responsive to a pervasive market need. I expect that the program will be extremely successful, and I look forward to seeing its first graduates on the market.

Sincerely,

Terrence August  
Associate Professor of Innovation, Technology and Operations  
Rady School of Management  
University of California, San Diego  
taugust@ucsd.edu  
(858) 822-7452
Dear Professor Bhargava and Professor Naik,

I very much enjoyed reviewing your proposal for a Master of Science in Business Analytics (MSBA) program at UC Davis. The proposal is well written and provides compelling arguments to support the contention that the program will be a successful endeavor. I strongly believe that graduates from this program will be in high demand and that student interest will follow suit.

I have been particularly interested in the area of business analytics education for some time and am the co-chair (with Professor Terrence August) of a proposed Master of Science in Business Analytics degree program at UC San Diego's Rady School of Management. My opinions are informed by extensive interaction with businesses (e.g., through Rady’s Center for Business Analytics) to understand the demand for business analytics professionals. Let me start by describing the clear strengths of the proposal:

**Faculty and courses**

A consistent theme in conversations with companies is their inability to find qualified people in the area of Business Analytics. The required skill-set includes statistics, machine learning, etc. but but also the ability to communicate complex analyses and insights effectively. The proposed program blends both the technical and the 'soft' skills in an excellent balance. Although new faculty will need to be hired to accommodate the expanding student base, the current faculty are very well positioned to offer the courses needed to produce outstanding graduates. For most classes there are several faculty with the qualifications to teach it.
Location

The program will have access to a pool of student applicants and company recruiters in, what has been termed, the heart of the knowledge economy. The large number of supporting letters from companies is further evidence that neither student demand nor graduate placement will be a concern.

Degree type

The proposal lists the degree program as a Master of Science in Business analytics. I believe the Master of Science designation is a requirement for success. A comprehensive review of analytics programs in the US conducted by the Institute for Advanced Analytics at North Carolina State University shows that 69 out of 75 programs use Master of Science. All Business analytics programs surveyed use the Master of Science designation. School offering MS degrees in Data Science, Analytics, and Business Analytics include Northwestern, Georgia Tech, NYU, John Hopkins, Columbia, Michigan State, Arizona State, Carnegie Mellon, University of Minnesota, Indiana University, Notre Dame, Rochester, Washington University, University of Maryland, Harvard, and Stanford. Of the 23 specialized master's programs in data or business analytics, technology management, or data- related specialty referenced by MBA.com, the official website of the GMAT (Graduate Management Admissions Test), 19 use the Master of Science designation. It is clear that the Master of Science in Business Analytics degree is the recognized and valued degree type.

In sum, the proposal appropriately highlights the virtues of the new degree program. Although, I have no major concerns there are a few areas in the proposal that could perhaps use some clarification.

Facilities and units

Although the facilities and location for the program are outstanding, at first glance, the time slots proposed for the program at the San Ramon campus seemed somewhat unusual. I then realized that the program was aimed at working professionals that could only attend classes in the evenings and on weekends. I do wonder, however, if working professionals will be able to complete 40 units of course work in 10 months? Also, I did not see information in the proposal that indicated if the facilities are sufficient to house multiple cohorts.

Prerequisites

The proposal lists a comprehensive set of prerequisites for applicants in the areas of programming, math, and statistics. It was not clear to me, however, if these same requirements applied also for those with several years of work experience in a business analytics role.
I am confident the proposed program will be a success and wish you the best of luck bringing it's promise to fruition.

Regards,

Vincent Nijs

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Vincent R. Nijs
Associate Professor of Marketing
Rady School of Management
University of California, San Diego
Wells Fargo Hall, 3W116
9500 Gilman Drive # 0553 | La Jolla, CA 92093-0553
858.822.7459 | vnijs@ucsd.edu
Professor Hemant K. Bhargava  
Jerome and Elsie Suran Chair in Technology Management  
Graduate School of Management,  
University of California Davis  
Gallagher Hall, Room GH-3108, Davis, CA 95616

Dear Professor Bhargava

It was my pleasure reviewing the draft of your Proposal for the Master of Science in Business Analytics at UC Davis. I am impressed with the thought and care that has gone into preparing this document. I have a few comments about the proposal that I have listed below.

Page 4
“Over sixty years, this process led to the modern business school, with research and practice creating new first rank academic disciplines such as Marketing, Operations, Organizational Behavior, Finance and Accounting.”

Comment: Could you add MIS and Strategic Management to this list of new academic disciplines?

Page 8
“Because much of the leading-edge activity in business analytics takes place outside academia, we anticipate using part-time adjunct instructors.”

Comment: You may want to modify this to read:
Because much of the leading-edge implementation activity in business analytics takes place outside academia, we anticipate using part-time adjunct instructors to teach practice-oriented courses. One example could be using contemporary analytics software that is deployed in industry.

Page 9
“An industry-sourced team project serves as the spinal cord to provide hands-on opportunity to learn analytical methods and concepts imparted in the classroom-based courses.”

Comment: could you change “…learn analytical methods…” to “…apply analytical methods…”
I would assume that analytics methods would have been taught in prior classes by your tenure-track faculty. The team project should be an opportunity to analyze a problem and then apply analytical methods.

Page 9
“Applicants are expected to enter the program with (i) an undergraduate degree in quantitative majors such as engineering, mathematics, statistics, econometrics, physics, and other majors;...”

Comment: Why did you omit business majors from this list? Marketing, Finance, MIS, Operations and other specializations in business would be excellent preparation for this new degree.

Page 23
You have listed a Visiting Assistant Professor (Sanjay Saigal) as a faculty member for this program.

Comment: What happens when this individual departs from UCD?

Page 29
Comment: It is not clear to me which faculty member is qualified to teach BAX247 Leveraging Big Data?

Page 32
I am pleased to see that you have requested three additional staff for administration of this new program. This is an important need to ensure proper administration of this program,

As you may know, we launched a Master of Science in Analytics at Georgia Tech with the first class of students enrolling in fall 2014. Our degree is unique in that it involves three units across Georgia Tech – the Scheller College of Business, the College of Computing, and the College of Engineering. We have admitted students in each of the three units who take a common core and then specialize, respectively, in Business Analytics, Computational Data Analytics, or Analytical Tools. You can get more information about our program at analytics.gatech.edu.

I wish you and your colleagues good luck with this new degree. You are addressing a critical need in the marketplace.

If you have any questions, please feel free to call me at +1.404.894.4378 or email me at sri@gatech.edu.

Sincerely,

Sri Narasimhan

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Sridhar Narasimhan
Professor & Senior Associate Dean
Erik Rolland, Ph.D.
Interim Dean, Professor of Management
School of Engineering, UC Merced

January 21, 2015

RE: Proposed Master of Science in Business Analytics program in the Graduate School of Management at UC Davis

I am pleased to write this letter of support for the proposed new graduate Master of Science in Business Analytics (MSBA) within GSM at UC Davis. After graduating with a Ph.D. in Business (management information systems), I have served as a faculty member in UC Riverside’s Graduate School of Management for 21 years, and as a management professor at UC Merced for 3 years. In these roles I have designed several cross-functional undergraduate and graduate management programs. Also, my area of research expertise is in the area of analytics. I find the MSBA proposal to be innovative, well thought out, and I fully support its establishment at UC Davis.

As a leading professional school and highly ranked research school, GSM at UC Davis fully understands the importance of training graduate students who master the skills needed to succeed in the workforce. The MSBA program adds a component of higher education that not only reflects the interests of many faculty in the school and across campus, but also addresses dire market needs for business analytics skills. California is a leader in terms of the analytics-related industries, and it is natural that the University of California would employ its resources in order to better serve its industry and its people. The solid backing that this proposal has garnered from outside the University is a clear message that the program is both attractive and much needed.

In particular, I find the strengths of the proposal to be its self-supporting financials, its engagement of faculty across the campus, and its support for adding additional GSM faculty in areas related to analytics. There is no doubt that this will add to both cross-functional activities and to the research strengths of UC Davis. Further, I find that the proposed program content is in line with the market needs, especially in the areas of providing analytics tools, such as R skills. From a personal and professional preference, I would also suggest adding Matlab to the toolbox used in the programs. The content is rigorous, and the pre-requisites may indeed be too stringent. This may be adjusted once the program gains experience with the applicant pool.

In summary, I find the proposed program to be well-designed and market-oriented, and should further enhance UC Davis’ academic programs and offerings. Therefore, proposal has my strongest support.

Respectfully yours,

[Signature]
Appendix B

Letters from Companies and the GSM Alumni Association Board
November 6, 2014

Graduate School of Management,
University of California Davis
Gallagher Hall
Davis, CA 95616

Dear Faculty Members,

The combination of copious storage and computing resources as well as development of advanced data analytic techniques has ushered in an era when many key decisions across various organizations are being made on the basis of understanding patterns in large amounts of data. With the constant rise in the number of data driven businesses, the need for talented people who are capable of extracting value from data and applying it to business has also risen steadily. Several academic programs have already appeared in the last few years to address this deficit.

As practicing data scientists and managers in a large corporation we already feel the necessity for managers trained with the technical knowhow of data analytics and feel there are very few academic programs that address this demand. The Graduate degree in Business Analytics at UC Davis with a well designed mix of techniques, domain knowledge and project-based learning will serve a pressing need within the industry and we welcome their effort with great enthusiasm. One cannot overemphasize the urgency for such a program and we are happy to explore opportunities for future impact and curriculum content review are that will serve the needs of industry while creating excellent academic opportunities for students.

We are confident the quality of education imparted by the program will be exemplary and the graduating classes of the business analytics program at UC Davis will fill the shoes of future top executives in industry. We look forward to the commencement of the program and wish the department great success.

Don Dini
Principal Data Scientist, AT&T

Rishiraj Pravahan
Principal Data Scientist, AT&T
September 20, 2014

Professor Hemant Bhargava  
Jerome and Elsie Suran Chair in Technology Management  
University of California Davis  
Gallagher Hall, Room GH-3108, Davis, CA 95616

Reference: MSBA Program Introduction letter

Dear Professor Bhargava,

Congratulations to you and UC Davis for your focus on Business Analytics and in conceptualizing the MSBA program.

Business Analytics skills are in short supply and this scenario will be amplified since demand for such skills is increasing as CEOs and CMOs (Chief Marketing Officers) of all businesses now increasingly recognize the value that can be locked from the data they own, the data they can access and the data that they can create leveraging ubiquitous devices and sensors.

In my recent role at IBM Silicon Valley, and now as COO at Blue Star Infotech, we are investing resources in innovative data capture technologies, data storage and real-time processing technologies, analytical modeling, business decision making modeling, individual preference learning systems, predictive and persuasive recommendation engines. We are also investing in developing proof of concepts which demonstrate how Business Analytics results can be published in real-time right at the point where the applicable decision is about to be made (time and place).

We are also increasingly seeing that Business Analytics capabilities are better deployed in Platform model and not in a specific product / or specific use-case model. This is a challenge and requires thinking with the right broader vision.

I am very keen to provide any assistance to this initiative and would like to contribute in terms of content, participation, providing internship opportunities as well as employment opportunities to the students of the MSBA program.

Please let me know how we can engage. With warm regards

Nishith Mathur  
Chief Operating Officer (COO)  
Direct: (408) 839-6020
20 October 2014

Dear Dr Bhargava,

Based on the business environment in which Mars is currently operating and in which it foresees it will be operating during the coming decades, we are delighted to note that UC Davis is aiming to offer a Graduate degree in Business Analytics. The explosion of data and cheap computing has brought Business Analytics to center stage, particularly in the knowledge industries of Silicon Valley and greater California. It will help fill the growing need for trained professionals at the intersection of business and analytics, and we hope specifically in areas that interact with the nexus of food, agriculture and health. Industry today needs business school graduates to manage not only people, processes and resources, but also information assets and data-driven decisions. Information-derived decision-making is becoming a universal core competence, much like Finance or Marketing. Ideas and techniques from engineering and mathematics are rapidly infiltrating all management functions, creating a revolution in business education.

After reading the proposal and also speaking with you, we feel the proposed program content is solidly designed in terms of its mix of tools, techniques, and domain knowledge. It is distinctive in its use of project-based learning as the centerpiece of the program, and in its recognition of organizational effectiveness issues as being central to the success of any Analytics effort in an organization.

We are pleased to offer support at this time, and would be interested in exploring how we can get involved in shaping the program and curriculum, in hiring and placing the graduates, and in providing financial or other support for the most distinctive elements of this program.

Since rely,

Please do not hesitate to contact me if you feel further discussion would be helpful.

Harol hmitz/PhD
Chief Science Offi,Z:efr
Mars, Incorporated
Attention:
Dr. Prasad A. Naik, Professor of Marketing
Graduate School of Management, University of California Davis, Davis, CA 95616
Dr. Hemant K. Bhargava
Graduate School of Management, University of California Davis Gallagher Hall, Room GH-3108, Davis, CA 95616

Dr. Prasad and Dr. Bhargava,

I am glad to hear that UC Davis is aiming to offer a Graduate degree in Business Analytics. The explosion of data and accessible computing has brought Business Analytics to center stage, particularly in the knowledge industries of Silicon Valley and greater California. It will help fill the growing need for trained professionals at the intersection of business and analytics. Industry today needs business school graduates to manage not only people, processes and resources, but also information assets and data-driven decisions. Information-derived decision-making is becoming a universal core competency, much like Finance or Marketing.

I believe that the proposed program content is well designed in terms of its mix of tools, techniques, and domain knowledge. It is distinctive in its use of project-based learning as the centerpiece of the program, and in its recognition of organizational effectiveness issues as being central to the success of any Analytics effort in an organization.

I am pleased to offer support at this time, and I would be interested in exploring how Kaiser Permanente can get involved in shaping the program and curriculum to best prepare candidates for Business Analytics in Health Care. Specifically, perhaps some elective courses could include areas specific to the health care industry.

I am also excited about the San Ramon proximity to our IT operations in Pleasanton and I see potential for hiring opportunities when this program is up-and-running. Thank you for providing me with the opportunity to voice my support for this kind of program.

Best regards,

Scott McGuckin
Director, National University Relations
November 4, 2014

Hemant K. Bhargava
University of California Davis Gallagher Hall
Room GH-3108, Davis, CA 95616

Dr. Bhargava,

We are delighted to hear that UC Davis is aiming to offer a Graduate Degree in Business Analytics. Analytics is at the core of GroupM’s strategic advantage. We have a strong need for talented individuals who are well trained and can bring a multi-function and multi-disciplinary approach to addressing business problems in a scientific manner.

Sincerely,

_Cary Tilds_
Chief Innovation Officer
GroupM
Dear Hemant:

I am a former UC Davis Foundation board member as well as a past one of the School of Management's Dean's Advisory Council. It has come to my attention that the school is actively considering expanding its business analytics program to focus on a more applied approach that will enhance students' ability to pursue career opportunities with job ready skills.

Crossings TV, an ethnic language cable programming service, in a half-dozen, large, US markets, has employed analytics to pioneer a new audience measurement technique. Ironically, the employee masterminding this is a Davis Management School graduate, Kurt Olmstead. He took all the courses then available related to analytics, but has significantly enhanced his knowledge in this regard subsequently. With his help, Crossings is creating a much more valuable way of interpreting
our audience for advertisers and others at a fraction of the cost otherwise possible.

We believe our experience is the tip of the iceberg, not only for media, but also, across all sectors of the economy. As an employer and supporter of the school, I would strongly support any effort, not only, to expand the school's activity in this area, but also, to do so in a way that gives students and employers a fast track to value creation in today's dynamic marketplace.

Sincerely,

Frank Washington
CEO
Dear Provost Hexter,

I am writing as a representative of the Graduate School of Management's Alumni Association in order to support the UC Davis Faculty Improvement Grant to establish a new Business Analytics program within the GSM. The GSM Alumni Association strongly believes that expanding our business school's role in analytics and data science is both timely and urgent. We cannot think of a higher impact investment of University resources than bringing on board new faculty to build academic capacity and graduate analytics professionals demanded by employers, both in Northern California and globally.

As you are undoubtedly aware, a significant percentage of GSM alumni practice in technology-related fields and companies. Speaking from my own experience, I can tell you that the preponderance of data that can now be tracked and managed in every aspect of business can be overwhelming, as illustrated by the emergence of many "Big Data" initiatives that are still more concept than reality. In today's competitive environment, making critical business decisions requires more people with skills in data organization/structure, analysis, and interpretation. Every industry has its own issues with data (volume, structure, composition, etc.) that continue to overwhelm and impede progress, rather than create insight. This is why the proposed program for business analytics at the GSM is incredibly timely and appropriate for the business needs of today, and more importantly, of tomorrow!

As analytics grows ever more critical to business performance, we believe it is the right time for the GSM to assert itself as a player in this emerging professional setting. The need for business training in analytics beyond the standard MBA curriculum has become clear to those of us who have both access to the volumes of data and a need for people to take the data and provide actionable insights. In my healthcare-related industry, I continually work with large phannaceutical clients who are struggling with the reams of claims, registry, and prescription data and, yet, are still unable to clearly understand the competitive landscape. We have been hired by "Big Data" companies to help them better understand their own data. The lack of well-trained business analytics professionals hampers my ability to find appropriate hires to meet client and industry demand. Given the relative lack of university-based programs in analytics and data science, we have to rely on internal training to fulfill these personnel needs. When we do consider hiring analytics professionals straight from school, it is usually from out-of-state or international programs.

The GSM has a unique opportunity to get ahead of the curve and provide a much needed resource to the market in the form of well-rounded professionals who have been specifically trained to make sense of the available market data and provide important insights and calls to action as a result of their skills. The value proposition of the program is to merge the critical competencies required to manage and evaluate data with a balanced business acumen that will turn data into actionable insights for their companies.
As actively contributing alumni, the GSM Alumni Association continually looks for opportunities to give back to both the GSM and UC Davis. Our board is excited by the opportunity to re-engage via an initiative that promises immediate impact and applicability to our professions. With that in mind, we respectfully recommend a favorable consideration of the Business Analytics proposal by Professors Bhargava, Naik, and Saigal to advance the mission and excellence of the GSM and the University.

Please feel free to contact me if you have any questions.

egards,

Roger

UC Davis GSM, Class of 1991
President, GSM Alumni Association
e-mail: roger@time4epi.com
Cell: 50-766-1883
September 24, 2014

Professor Hemant Bhargava
Jerome and Elsie Suran Chair in Technology Management
University of California Davis
Gallagher Hall, Room GH--3108, Davis, CA 95616

Reference: MSBA Program Introduction letter

Dear Professor Bhargava,

Congratulations to you and UC Davis for your focus on Business Analytics and in conceptualizing the MSBA program.

In my capacity as Head of Ecommerce for Yahoo Small Business, business analytics tools and skills are now an imperative both for any business, as well as for companies providing business tools. All modern marketing tools and business metrics require a deep understanding of analytics.

I returned to Yahoo last year through an acquisition of a company called Lexity. Lexity’s analytics product, Lexity Live, provides actionable real--time insights to online commerce businesses. This technology was one of the key motivations for the acquisition and the rebranded product, called Yahoo Live Web Insights, is now available to millions of business owners who use Yahoo’s business services.

With such tools, it is critical for business owners and entrepreneurs to understand the value provided, and to be able to grasp the power of the insights and data presented. Powerful analytics tools provide several levers for customization, and training is required to take full advantage of the technology.

In today’s world of metrics--driven marketing, it is mandatory for marketing and sales professionals to analyze data to make sound business decisions. Yahoo Small Business offers automated marketing tools for advertising on online channels such as Amazon, Bing, Facebook, Google, Pinterest, Twitter and Yahoo. Training is critical in order to help professionals understand performance--driven marketing, SEO, SEM, and social marketing as budgets increasingly shift to these sophisticated online channels.

I am very supportive of bringing in students with such skills into our group through internships, etc., as such analytical background and skills are often in short supply in the context of the various product and marketing roles we require.

Please to let me know how we can help.

Regards,

Dr. Rajat Mukherjee
Head of Ecommerce
Yahoo Small Business
September 23, 2014

Professor Prasad Naik
University of California Davis

Reference: MSBA Program

Dear Prof. Naik,

I am quite excited to hear about the concept of the MSBA program and sincerely hope that UC Davis considers formalizing the MSBA program.

In my opinion, this program is an excellent idea and will help address a growing skill gap. Ever since I graduated from the US Davis program I have increasingly believed that an MBA education is a good general education but it does not provide enough depth to support workforce needs for an analytics driven organization.

As you know I run a company, which provides cutting edge, artificial intelligence based marketing optimization solutions to CPG and Retail clients. At Kvantum, we hire for a skill set that overlaps an understanding of business fundamentals, analytic rigor and knowledge of computing. We have tried to hire PhDs, computer scientists and MBAs, and have tried to put them in a collaborative work environment to develop complete well-rounded solutions. In general we have been successful only when our team members are able to acquire some combination of computing, statistical analysis and business domain knowledge. This requires significant training and investment.

We are at the start of a trend where decision sciences & analytics would be a key competitive strength of an organization, and the prevalence of this organizational capability would determine market share, profitability and relevance of a company’s products & brands to its consumers. A course like MSBA would formally prepare students to get trained on the right overlap of computing, statistics and business domain resulting in a work place which is much more suited for an analytics organization than a plain vanilla MBA.

In my capacity as the CEO of Kvantum Inc., I would wholeheartedly support such program, and would be happy to contribute by providing content, participation in developing a curriculum, internship opportunities and campus placements for the students graduating from this program. Please let me know how you would like me to engage in getting this program started.

Best Regards,

Harpreet Singh
CEO, Kvantum Inc.
Charlene T. Sailer, Ph.D.
324 Sandpiper Drive
Davis, CA 95616 (530) 220-5999
sailer@mindspring.com

To: Professors Hemant Bhargava and Prasad Naik
UC Davis GSM
One Shields Ave
Davis 95616

25 September 2014

Dear Professors Bhargava and Naik:

It is with pleasure that I write in support of your proposed new initiatives in Business Analytics (BA). I am a graduate of the UC Davis MBA program (class of 2003). In my career as a geospatial scientist, I have supported customers in the defense and intelligence communities as a consultant, a Federal government manager and as a Research Professor for the Naval Postgraduate School in Monterey. During my tenure in these workplace positions, I have noted that new hires were generally lacking experience in data mining, visual analytics, modeling and other techniques that are included in the field of BA. It was clear that my customers needed employees who could analyze very large data sets with diverse types of data and formats. To develop solutions, I worked with teams of technical specialists to develop innovative approaches to each set of problems and provided guidelines, protocols and prototype systems for approaching similar problems in future. We utilized BA techniques integrated with Geographic Information Systems and Data Base Management systems to develop solutions to many of the problems the agencies were studying. Based on ten years of working with government customers and defense industry professionals it is my observation that there is a paucity of qualified specialists with experience in BA techniques.

I am excited about the new Business Analytic Programs that the GSM is proposing. The BA initiative has the potential to provide California industries with professionals who better understand how to manage an organization’s information assets and who have experience with a suite of techniques for forecasting, analyzing trends, and essentially imbuing data with meaning. Professionals are needed who understand techniques for discriminating quality data that are germane to address an organization’s unique information needs and the skill sets to use BA approaches to detect trends, distinguish between normal patterns and rare events and mitigate risks for an organization that is expanding into new markets or product lines.

I feel this is an exciting opportunity for GSM, for the professionals who will apply to the program and for the organizations that will be successful in recruiting them. Please let me know if I can be of any further assistance.

Sincerely,

Charlene T. Sailer
Hemant Bhargava <hemantb@gmail.com>
To: Sanjay Saigal <sanjay.saigal@gmail.com>, Prasad Naik <panaik@ucdavis.edu>

Wed, Sep 24, 2014 at 10:18 AM

To whom it may concern:

We are delighted to hear that UC Davis is aiming to offer a Graduate Degree in Business Analytics. Analytics is at the core of the Kraft/Mondelez strategic advantage. We are always in the need for talented individuals who are well trained and fully equipped in this area. We feel the program is designed to make a difference in the industry and brings together a multi-function and multi-disciplinary approach to addressing business problems in a scientific manner.

I am pleased to support this effort at this time and am interested in helping shape the design and implementation of the program.

Kind Regards,

Sudeep Haldar, Ph.D
Senior Director, Strategic Insights
Global Strategy
Mondelez International
Deerfield, IL
Letter of Support for a GSM Master's of Science in Business Analytics

Benigno Salazar <benigno_vs@hotmail.com>  Thu, Sep 25, 2014 at 11:00 PM
To: "Hemantb@ucdavis.edu" <hemantb@ucdavis.edu>, "panaik@ucdavis.edu" <panaik@ucdavis.edu>
Cc: Benigno Salazar <benigno.vogelmann-salazar@wellsfargo.com>, "janagai@ucdavis.edu" <janagai@ucdavis.edu>, "aaravind@ucdavis.edu" <aaravind@ucdavis.edu>

Dear Professors Naik and Bhargava,

Please share this letter of support with UC Davis GSM faculty and administration as you deem necessary.

I am excited to learn that the UC Davis GSM may start a Master's of Science in Business Analytics (MSBA). I support this initiative. As a marketing analytics consultant, I am currently applying the business analytic skills I learned at the GSM and through experience for over 8 years. During the time I attended the GSM 15 years ago, a data science or business analytics concentration or degree did not exist. However, I was fortunate to have had the course offerings, and selections with which I was able to combine concentrations that enabled me to transition into a business analytics role professionally. My course work included a Marketing Research class with Professor Naik, where I learned skills I am applying today. I would have appreciated a program like the proposed MSBA.

Now, the need for skilled and experienced data scientists and business analytics professionals has grown tremendously. A program dedicated to business analytics could really help meet business demands in today's data rich business environment. Data intensive companies, like information technology, market research, and financial services companies have a high demand for business analytics professionals. UC Davis' MSBA could prepare students to meet those business analytic needs. One of the things I love about the proposed program is that it will include an experiential component which is essential in preparing exceptional business analytics consultants and leaders. This will help UC Davis MSBA graduates be known as strategic business analytics consultants rather than mere analysts.

As plans with the program move forward, please let me know how I can help. I would welcome an opportunity to help by advising in developing the program or sharing my industry experience in practicing business analytics. Please keep me informed on decisions about the MSBA program proposal and on next steps.

Sincerely,

Benigno Salazar
UC Davis GSM Class of 1999
benigno_vs@hotmail.com

cc.
Judy Nagai
Ashwin Aravindakshan
Prof. Hemant Bhargava
UC Davis,
Graduate School of Management

Dear Hemant,

I am delighted to note that UC Davis is aiming to offer a Graduate degree in Business Analytics. The explosion of data and cheap computing has brought Business Analytics to center stage, particularly in the knowledge industries of Silicon Valley and greater California. It will help fill the growing need for trained professionals at the intersection of business and analytics. Industry today needs business school graduates to manage not only people, processes and resources, but also information assets and data-driven decisions. Information-derived decision-making is becoming a universal core competence, much like Finance or Marketing. Ideas and techniques from engineering and mathematics are rapidly infiltrating all management functions, creating a revolution in business education.

I feel the proposed program content is solidly designed in terms of its mix of tools, techniques, and domain knowledge. It is distinctive in its use of project-based learning as the centerpiece of the program, and in its recognition of organizational effectiveness issues as being central to the success of any Analytics effort in an organization.

I am pleased to offer support at this time, and would be interested in exploring how I can get involved in shaping the program and curriculum, in hiring and placing the graduates, and in providing financial or other support for the most distinctive elements of this program.

Sincerely,
Mukesh Dalal

Chief Scientist at BAE Systems
Dear Provost Hexter,

My name is Raymond Austin, I am on the GSM Alumni Association Board and strongly support the UC Davis faculty improvement grant to establish a new Business Analytics program within the Graduate School of Management The GSM Alumni Association strongly believes that expanding our business school’s role in analytics and data science is both timely and urgent.

As you are aware, a significant percentage of GSM alumni including myself are in technology related fields and companies. As a senior leader within the marketing organization at NetApp based in Sunnyvale, CA, an industry leader in Enterprise data management and storage solutions, my role includes managing a team of marketing professionals who help customers understand the value of using NetApp for business critical environments. We market a full portfolio of Analytics solutions to customers, working with a broad eco-system of ISV partners. NetApp solutions for Analytics is an emerging growth area for us and is targeted at companies who are implementing data-driven initiatives to significantly accelerate their decision making, increase business agility and improve overall ROI. From my own experience at NetApp, the proposed program for business analytics at the GSM is very timely and appropriate for the business needs starting today.

As active member of the GSM community, we look for opportunities to give back to the GSM and UC Davis. Our board is excited by the opportunity support an initiative that will ultimately deliver huge impact and positive outcomes to the University and community as a whole. With that in mind, we would respectfully recommend a favorable consideration of the Business Analytics proposal by Professors Bhargava Naik and Saigal to advance in the mission of the GSM and the UC Davis.

Please contact me if you have any questions,

Best Regards,

Raymond Austin
GSM Alumni Board Member and UC Davis Alum (MBA ’00, BS EE ’92)
Director, Product and Solutions Marketing at NetApp
Appendix C

List of Universities offering MSBA degrees
<table>
<thead>
<tr>
<th>University</th>
<th>Program</th>
<th>Duration (Months)</th>
<th>Fees (Resident)</th>
<th>Class Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>W.P. Carey School of Business</td>
<td>MSBA</td>
<td>9</td>
<td>31300</td>
<td>90</td>
</tr>
<tr>
<td>Arizona State University</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lindner College of Business</td>
<td>MSBA</td>
<td>9</td>
<td>21000</td>
<td>86</td>
</tr>
<tr>
<td>University of Cincinnati</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stern School of Business New York University</td>
<td>MSBA</td>
<td>12</td>
<td>67500</td>
<td>60</td>
</tr>
<tr>
<td>University of New York</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>McCombs School of Business University of Texas at Austin</td>
<td>MSBA</td>
<td>10</td>
<td>36000</td>
<td>53</td>
</tr>
<tr>
<td>University of Southern California</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marshall School of Business</td>
<td>MSBA</td>
<td>12</td>
<td>47000</td>
<td>50</td>
</tr>
<tr>
<td>University of Southern California</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cox School of Business Southern Methodist University</td>
<td>MSBA</td>
<td>9</td>
<td>48000</td>
<td>40</td>
</tr>
<tr>
<td>University of Southern Methodist University</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fordham University, The Jesuit University of New York</td>
<td>MSBA</td>
<td>12</td>
<td>39000</td>
<td>38</td>
</tr>
<tr>
<td>University of New York</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School of Business George Washington University</td>
<td>MSBA</td>
<td>12</td>
<td>50000</td>
<td>35</td>
</tr>
<tr>
<td>University of Southern California</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eli Broad College of Business Michigan State University</td>
<td>MSBA</td>
<td>12</td>
<td>52000</td>
<td>30</td>
</tr>
<tr>
<td>University of Southern California</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simon Business School University of Rochester</td>
<td>MSBA</td>
<td>14</td>
<td>63000</td>
<td>16</td>
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</table>
Appendix D

Budget Spreadsheet
### Key Stats

<table>
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<tr>
<th>Annual enrollment (SSDP program)</th>
<th>0</th>
<th>40</th>
<th>40</th>
<th>80</th>
<th>80</th>
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<tr>
<td>Number of credits hours taught per year</td>
<td>40</td>
<td>40</td>
<td>80</td>
<td>80</td>
<td>80</td>
<td>80</td>
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### Revenue

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual program fee per student</td>
<td>52,000</td>
<td>52,000</td>
<td>53,560</td>
<td>55,167</td>
<td>56,822</td>
<td>58,526</td>
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<tr>
<td>Annual student services fee</td>
<td>441</td>
<td>454</td>
<td>468</td>
<td>482</td>
<td>496</td>
<td>511</td>
</tr>
<tr>
<td>Annual campus based fees</td>
<td>262</td>
<td>270</td>
<td>278</td>
<td>286</td>
<td>295</td>
<td>304</td>
</tr>
<tr>
<td>Health insurance</td>
<td>44</td>
<td>45</td>
<td>47</td>
<td>48</td>
<td>50</td>
<td>51</td>
</tr>
<tr>
<td>Total annual fee per student</td>
<td>52,747</td>
<td>52,769</td>
<td>54,352</td>
<td>55,983</td>
<td>57,663</td>
<td>59,392</td>
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<tr>
<td>Annual student fees</td>
<td>2,110,776</td>
<td>2,174,100</td>
<td>4,478,645</td>
<td>4,613,005</td>
<td>4,751,395</td>
<td></td>
</tr>
<tr>
<td>Total Revenue</td>
<td>2,110,776</td>
<td>2,174,100</td>
<td>4,478,645</td>
<td>4,613,005</td>
<td>4,751,395</td>
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</tbody>
</table>

### Expenditures

#### Faculty

<table>
<thead>
<tr>
<th>Item</th>
<th>0</th>
<th>18</th>
<th>36</th>
<th>54</th>
<th>60</th>
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<tbody>
<tr>
<td>Total number of new faculty</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>5</td>
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<tr>
<td>Estimated new faculty salary per person</td>
<td>190,182</td>
<td>195,887</td>
<td>201,764</td>
<td>207,817</td>
<td>214,052</td>
</tr>
<tr>
<td>Total new faculty salary</td>
<td>0</td>
<td>0</td>
<td>403,528</td>
<td>831,268</td>
<td>1,070,258</td>
</tr>
<tr>
<td>Total new faculty summer support</td>
<td>0</td>
<td>89,673</td>
<td>184,726</td>
<td>237,835</td>
<td>244,970</td>
</tr>
<tr>
<td>Total research and teaching support (RATS)</td>
<td>15,000</td>
<td>30,000</td>
<td>60,000</td>
<td>75,000</td>
<td>75,000</td>
</tr>
<tr>
<td>Subtotal of new faculty costs</td>
<td>0</td>
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<td>1,075,994</td>
<td>1,383,093</td>
<td>1,422,335</td>
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<tr>
<td>Current faculty (overload units taught)</td>
<td>12</td>
<td>8</td>
<td>12</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Per credit overload rate</td>
<td>7,000</td>
<td>7,000</td>
<td>7,210</td>
<td>7,426</td>
<td>7,649</td>
</tr>
<tr>
<td>Subtotal of current faculty costs</td>
<td>84,000</td>
<td>57,680</td>
<td>89,116</td>
<td>61,193</td>
<td>0</td>
</tr>
<tr>
<td>Executive Director (units taught)</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
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<td>Lecturers (units taught)</td>
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<td>Lecturers (per credit rate)</td>
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<td>Subtotal of lecturer costs</td>
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<td>Total Faculty Expenses</td>
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#### Staff and Instruction

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<th>160,000</th>
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<th>164,800</th>
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<td>Executive Director</td>
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<td>13,019</td>
<td>13,409</td>
<td>27,623</td>
<td>28,452</td>
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<tr>
<td>Business Office (Analyst I)</td>
<td>52,075</td>
<td>13,019</td>
<td>13,409</td>
<td>27,623</td>
<td>28,452</td>
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<td>Marketing (Analyst II)</td>
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<td>14,775</td>
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<td>59,099</td>
<td>60,872</td>
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<td>Student Affairs (Admissions and Recruitment)</td>
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<td>70,000</td>
<td>70,000</td>
<td>72,100</td>
<td>74,263</td>
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<td>IT (Programmer III)</td>
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<td>Development - Associate Director</td>
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<td>Analyst 4 (Corporate/Project Coordinator)</td>
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<td>33,800</td>
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<td>71,717</td>
<td>73,868</td>
<td>76,084</td>
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<td>2,943</td>
<td>18,185</td>
<td>18,730</td>
<td>19,292</td>
<td>19,871</td>
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<td>Teaching Assistance (fee remission)</td>
<td>5,500</td>
<td>33,990</td>
<td>35,010</td>
<td>36,060</td>
<td>37,142</td>
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<td>Total Staff and Instruction Expenses</td>
<td>183,800</td>
<td>547,138</td>
<td>563,552</td>
<td>656,824</td>
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#### Benefits

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<td>33,251</td>
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<td>Summer support</td>
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<td>75,533</td>
<td>84,193</td>
<td>93,304</td>
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<td>Staff-ExecutiveDirector</td>
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<td>Teaching Assistance (fee remission)</td>
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<td>442</td>
<td>455</td>
<td>469</td>
<td>483</td>
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<td>Total Benefits Expenses</td>
<td>93,027</td>
<td>264,828</td>
<td>455,867</td>
<td>725,457</td>
<td>884,266</td>
<td>949,136</td>
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### Appendix D: Budget for Master of Science in Business Analytics (SSDP)

#### Key Stats

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<tr>
<th>Academic Year</th>
<th>2015-16</th>
<th>2016-17</th>
<th>2017-18</th>
<th>2018-19</th>
<th>2019-20</th>
<th>2020-21</th>
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<td><strong>Program Year</strong></td>
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<td>1</td>
<td>2</td>
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<td><strong>Key Stats</strong></td>
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<td>Annual enrollment (SSDP program)</td>
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<td>40</td>
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<td>80</td>
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<td>Number of credits hours taught per year</td>
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<td>80</td>
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#### Operating Expenses

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<td>Marketing launch</td>
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<td>Ongoing marketing costs</td>
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<td>Analytics software and continuous program innovation (faculty)</td>
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<td>50,000</td>
<td>100,000</td>
<td>100,000</td>
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<td>84,000</td>
<td>168,000</td>
<td>168,000</td>
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<td>Ongoing IT operating costs</td>
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<td>Program Chair Course Release (units)</td>
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<td>Per credit overload rate</td>
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<td>7,210</td>
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<td>Student scholarships</td>
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<td>Student fees</td>
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<td>Remedial student services costs</td>
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<td>25,242</td>
<td>25,999</td>
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<td>Student meals (cost per student per year)</td>
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<td>61,800</td>
<td>127,308</td>
<td>131,127</td>
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<td>Lease costs</td>
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<td>115,000</td>
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<tr>
<td>Campus Fees (SSDP and Grad Studies)</td>
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<td>35,000</td>
<td>60,000</td>
<td>60,000</td>
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<td>UCDP Tax</td>
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<td><strong>Total Operating Expenses</strong></td>
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#### Total Expenditures

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<td>-155,847</td>
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<td>margin %</td>
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<td>10.75%</td>
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<td>49,966</td>
<td>52,574</td>
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<td>net income per student</td>
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<td>6,017</td>
<td>5,088</td>
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Appendix E

Responses to External Faculty Letters
Responses to Faculty Reviews

As part of the expedited review process, the Steering Committee of the GSM's Business Analytics proposal invited four faculty leaders to review a draft Proposal. All of them have led development of Analytics-related programs at their universities. Their reports offer compliments, enthusiasm, and constructive suggestions. The Steering Committee incorporated their suggestions into the final proposal as noted below.

Program Strengths

The general sentiments of the reviewers were strongly positive, both towards the idea of a Business Analytics program and the proposal (i.e., program design) itself. Associate Dean Sridhar Narasimhan at Georgia Tech., writes, “I am impressed with the thought and care that has gone into preparing this document.” Prof. Terrence August, from UC San Diego, states that “This is an excellent proposal for a highly impactful degree program … It is clear that the program chairs have carefully constructed a rigorous program that will graduate successful leaders who can spearhead business analytics initiatives.” Prof. Vincent Nijs, also from UC San Diego expresses a similar sentiment, “The proposal is well written and provides compelling arguments to support the contention that the program will be a successful endeavor.” Dean Erik Rolland of UC Merced writes, “I find the MSBA proposal to be innovative, well thought out, and I fully support its establishment at UC Davis.”

Reviewers also commented positively on the specific aspects of the proposal, including market analysis, curriculum design, placement opportunities for graduates. Reviewers particularly noted the innovative and differentiating aspects of the curriculum, its emphasis on hands-on applied learning through a program-length project, and its treatment of organizational effectiveness issues. The faculty was commended for its strong expertise and versatility with respect to the program's educational needs. Reviewers also commended the faculty hiring plan, noting that the addition of Business Analytics faculty would help UC Davis leverage its location near the world's epicenter of analytics-related innovations and business activities. Selected quotes are given below.

Differentiating Content and Design

As noted in the proposal, the MSBA degree has three differentiating features: location, project, and soft skills.

- Proximity of the GSM San Ramon campus to Silicon Valley, which is the global epicenter of the analytics revolution, offers a competitive advantage relative to many other programs.

- The 10-month long practicum course provides hands-on learning opportunities to students. Prof. Terrence August of UCSD states, “I really like the program design and the integrated approach being taken. The commitment of 25% of the curriculum dedicated to an ongoing, real world business analytics project is quite commendable. This aspect certainly stands out from other business analytics programs and … graduating students will have a competitive advantage in the marketplace.” and “I believe this proposal’s commitment to a 10 month immersion project will be a differentiator and that graduating students will have a competitive
• The soft skills component of the curriculum involves transforming business problem into analytical framework and articulating the value from algorithms and insights. Prof. Vincent Nijs concurs: “A consistent theme in conversations with companies is their inability to find qualified people in the area of Business Analytics. The required skill set includes statistics, machine learning, etc. but also the ability to communicate complex analyses and insight effectively. The proposed program blends both the technical and the ‘soft’ skills in an excellent balance.” Likewise Prof. August adds: "What I like about this course is that it elevates the importance of communicating analytics, handling organizational challenges, and dealing with change (instantiating new ways of doing business). Business analytics projects will fail miserably if the leaders championing these projects do not possess the skill sets to educate and influence others in their respective organizations."

Market Need
Professor Terrence August wrote “Having this program, as designed, up and running would be an immediate success for both UC Davis GSM and bay area companies that have a demonstrated need for human resources with these important skill sets. Moreover, society will directly benefit in the future from new, improved, and even evolved products and services …” and "I believe the proposal makes a quite compelling argument that demand for this program will be very strong. As has been seen recently in industry, there is a high demand for data scientists who can make inferences from the vast amount of information collected by companies. However, there is an even greater demand for managers who are well-versed at identifying business opportunities, generating business insights, and developing business solutions."

Prof. Eric Rolland, Interim Dean, UC Merced, notes that “… California is a leader in terms of the analytics related industries, and it is natural that the University of California would employ its resources in order to better serve its industry and its people. The solid backing that this proposal has garnered from outside the University is a clear message that the program is both attractive and much needed.”

Prof. Vincent Nijs from UCSD says, “The large number of supporting letters from companies is further evidence that neither student demand nor graduate placement will be a concern.”

Faculty and Resources
Professor August notes, “Having taken a close look at the faculty profiles, it is also clear that UC Davis GSM has strong faculty representation that is more than capable of teaching the curriculum laid out in the proposal.”

Dean Rolland: "In particular, I find the strengths of the proposal to be its self-supporting financials, its engagement of faculty across the campus, and its support for adding additional GSM faculty in areas related to analytics. There is no doubt that this will add to both cross-functional activities and to the research strengths of UC Davis.”

Prof. Nijs: "Although new faculty will need to be hired to accommodate the expanding student base, the current faculty are very well positioned to offer the courses needed to produce outstanding graduates. For most classes there are several faculty with the qualifications to teach it.”
Suggestions

Operational and logistical details. Prof. Nijs questioned "... if working professionals will be able to complete 40 units of course work in 10 months?" Prof. August noted a similar concern, "While Saturday evenings and Sundays are currently underutilized at this facility, I do have reservations on whether students are very open to these times. This is probably worth investigating as the program moves forward."

Response: We recognized this concern and have now defined 3 target groups: non-working full-time students; working professionals with part-time jobs; and working professionals with full-time jobs, where companies offer work time release for professional development. Several companies have already provided verbal support for this idea. Furthermore, we are conducting additional market research to identify the best time slots for teaching.

Pre-requisites. Prof. Nijs noted that "The proposal lists a comprehensive set of prerequisites for applicants in the areas of programming, math, and statistics. It was not clear to me, however, if these same requirements applied also for those with several years of work experience in a business analytics role."

Response: Pre-requisites are undergraduate course work in statistics, mathematics, and computer science. As such, it is common to all enrolled students. For some deserving applicants who score high on other admissions criteria, we have budgeted resources to offer remedial courses. See section 6.6.

Advance Preparation. Prof. August suggested that we consider ways in which incoming students would have sufficient competence in data analysis and forecasting. He suggested "... it will pay dividends to have a well thought out mechanism to ensure that admitted students have sufficient time and resources to develop these competencies beforehand (perhaps an online class with videos that they work through with deliverables during the preceding summer or some other alternative)."

Response: We have incorporated this excellent suggestion by expanding the scope of "Remedial Courses" to include advance preparation via online coursework to all enrolled students during the summer months before classes begin in the Fall quarter. We have budgeted for such costs in section 6.6.

Curriculum 1. Prof. August suggested that instead of a fully core curriculum (lock-step), we should consider "... to have electives rather than lock-step (even if in each year it is a lock-step)."

Response. In early stages of the product launch, we intend to maintain a lock-step curriculum to minimize design complexity, which would enhance if we introduced elective courses. Indeed, as the program evolves, we will allow such electives in response partly to evolving scientific content and partly to evolving preferences and placements. For example, we would offer a few electives in "financial risk analytics" or "healthcare analytics" if a non-trivial portion of the cohort finds jobs in banking or medical industry, respectively.

Curriculum 2. Dean Rolland suggested "... adding Matlab to the toolbox used in the programs." and noted that "the pre-requisites may indeed be too stringent."

Response: We believe inclusion of Matlab is a syllabus-level detail that specific instructors will address as they create their syllabi for their courses. As for the pre-requisites, we replaced the stringent
statistics courses by new ones, namely, STA 130A or 130 B or 141, which are undergraduate level courses in Mathematical Statistics.

Other comments

• "Why did you omit business majors from this list? Marketing, Finance, MIS, Operations and other specializations in business would be excellent preparation for this new degree." (Prof. Sridhar Narasimhan).

  Response: We will target business and economics majors in the prospective applicant pool.

• “You have listed a Visiting Assistant Professor (Sanjay Saigal) as a faculty member for this program. What happens when this individual departs from UCD?” (Prof. Sridhar Narasimhan).

  Response: Attracting and retaining good faculty is critical to building an institution, and we will provide work environment and attractive compensation to minimize the occurrence of such disruptive events.

• “It is not clear to me which faculty member is qualified to teach BAX247 Leveraging Big Data?” (Prof. Sridhar Narasimhan).

  Response: Initially, when the program is launched, we will hire a qualified adjunct faculty with PhD in statistics or computer science working in big data analytics companies in Bay Area. We have budgeted for such costs; see Appendix D for the provision of adjunct faculty units. Over time we will recruit ladder-rank faculty to advance the scientific frontiers and complement teaching in this important area.
Appendix F

Incorporated Feedback from Multiple Constituencies in GSM
MS-Business Analytics

Staff briefly reviewed the preliminary budget for the proposed Master of Science in Business Analytics degree program. As the goal of the faculty proposers (Bhargava and Naik) is to move the proposal through the campus review process as quickly as possible, the staff agree that no major changes should be made to the budget at this time. However, the staff would like to note issues that should be addressed before the program is launched. Discussion regarding implementation could take place in internal GSM meetings that parallel the UC Coordinating Committee on Graduate Affairs review. Faculty comments were collected at the 1/28/2015 faculty meeting, during which the faculty voted unanimously to move the proposal forward in the review process.

1. Revenues
   ☒ Show program fees and student services fees separately (Stevens)
   ☒ Confirm a $5,000 cushion of per-student revenue-expenses (Virtanen)
   ☐ Request UCD Strategic Communications to perform additional market analysis regarding potential enrollment (Akin)
   ☒ Steidlmayer should create a table of 3-4 comparison programs, showing enrollment and fees (Shum)
   ☒ Potential revenue from gifts should not be included at this time (Nagai)

2. Faculty Expenses
   ☒ Confirm source of funding for faculty start-up funds (Kitchen)
   ☒ Confirm reapplication to the Hiring Incentive Program (Steidlmayer)
   ☒ Remove “allowance for sabbaticals and leaves” (Bhargava)
   ☒ Move 6 units of “new faculty (units taught)” to “lecturers (units taught)” in year 1 (Bhargava)
   ☒ Hire program director in January of year 0 (Bhargava)
     Response: Half of Executive Director salary shown in year 0 to indicate that hiring occurs half way through the year. Benefits updated accordingly.
   ☒ Hire admissions staff in year 0 (Bhargava)
   ☒ In year 0, show compensation costs for curriculum development course release to Bhargava and Naik (Bhargava)
     Response: I didn’t insert this because I believe that the School will cover the cost from a

---

1 A marked checkbox indicates that the proposed change has been implemented in the budget and/or proposal.
Dean’s discretionary fund (as you are compensated that class whether the proposal is approved or not). However, this does bring up the point that the program needs a faculty program chair; the MPAc program chair receives a one-course release for which the MPAc program compensates the School for replacement teaching costs. So, we might want to insert a faculty program chair and show an annual replacement teaching cost of $28,000 (4 units times $7,000/unit). The revised budget includes these costs.

3. Staff Expenses

☒ Revisit salary of SAOII; it may need to be closer to $70,000 given that the position is based in the Bay Area (Stevens)
Response: Budget was updated to show this position at $70,000

☒ Specify that the SAOII shown on the budget is for admissions and recruitment (Stevens)

☒ Specify that the Instructional Support position shown is an Analyst I (Stevens)

☒ Make sure that the estimated TA cost includes cost of fee remissions (Virtanen)

☒ Breakdown staff costs further to show that the program can cover indirect costs of “school staff” such as the Registrar, Career Services, Business Office (Kitchen)
Response: inserted Shum’s estimates of support staff costs (last item in this section) to address this point.

☒ Hire project coordinator in January of year 0.
Response: Half of salary shown in year 0 to indicate that hiring occurs half way through the year. Benefits updated accordingly.

☒ Update budget with support services costs (Shum)
Response: Insert Su-Lin’s spreadsheet for staff, catering, lease costs, and campus fees. To Su-Lin’s insert, I also include an Analyst 4 for project coordination and teaching assistance.

4. Operating Expenses and Considerations

☒ Confirm that amount shown on one line item (either “analytics and administration” or “annual IT expenditure”) will cover start-up technology costs for new faculty (Mrizek)

☒ Change “analytics software and administration” to “continuous program innovation” (Bhargava)

☒ Update “routine operating costs” so that the calculation is based on the current GSM IT budget of $1,200/student x 500 students. Increase to $2,000 per student for MS-BA budget so that annual cost is $80,000 for years 1 and 2, $160,000 for years 3-5. (Bhargava)
Add “IT capital expense costs (for faculty and students)” with $200,000 annual expenditures in years 1 and 3. (Bhargava)

Confirm that operating expenses are sufficient to cover the cost of increasing T1 bandwidth in the San Ramon location (Stevens)
Response: Not increasing T1 peak load traffic; recommendation not updated. (Bhargava)

Determine if meals are to be served to students (Stevens)
Response: Meals will be served; estimates inserted from Su-Lin’s estimate. (Steidlmayer)

Include costs for travel (Virtanen)
Response: $15,000/faculty RATS funding added. (Steidlmayer)

Add SSDP Assessment Fee at 1.5% of revenue (Virtanen)

Proposed marketing budget of $150,000 is adequate for the first year and in line with our average ad spend for our part-time MBA degree programs (The MPAc program is not a comparable program). Above and beyond these advertising and marketing costs would recommend a .25-.50 FTE of an Analyst IV for marketing support for the program. (Akin)
Response: Using the current GSM per-student marketing costs of $1,400 ($700,000/500 students), “ongoing marketing costs” include $56,000 annual expenses in years 1 and 2; $112,000 annual expenses in year 3-5. “Marketing launch costs” is estimated at $100,000 per year for years 0-2. (Bhargava)

Response: update of .25FTE for Marketing (Analyst II) was included in Su-Lin’s estimates and inserted.

Coordinate with Associate Dean and Academic Operations Director regarding the scheduling of classes as the proposal refers to use of the San Ramon time “outside of MBA hours” but the MBA program is offering more classes over the whole weekend that might leave no capacity for the MS-BA.

Place “remedial” costs for students who lack certain knowledge (this would occur in summer) (Bhargava)
Response: add line item for a summer prep course based on estimates from MBA Quantitative Fundamentals costs.

Lease costs updated with Su-Lin’s estimates.

2 Tim also proposed a correction of the use “GSM’s Silicon Valley campus in San Ramon” on page 35 of the proposal text. [Response: Thanks; see p. 38.]
5. Recruitment and Enrollment

- Because it is set at 12 units per quarter, international students could be attracted to the program as it meets visa requirements. Consider targeting international students in order to meet enrollment targets. (M. Yetman and R. Yetman)

  *Response: we now target full-time domestic and international students.*

- Review proposal to establish the right proportion of faculty in program. M. Yetman feels that the number of Senate faculty teaching might be a burden on faculty schedules and the program budget. However, O. Rubel feels that Senate faculty in the program signals the high value of the program.

  *Response: the proposal includes both adjunct and ladder-rank faculty, contributes to lease costs of existing MBA program, and generates surplus without financial burden on the state or UC Davis or other GSM programs.*

- Perform market analysis on full-time programs that are held at night to see if this is feasible for students. Also, if the program is launched in this format, be honest in marketing materials and let students know that is the format/schedule.

  *Response: Marketing communications on website and other vehicles will highlight these features.*

- Consider offering it as a full-time, day program (Barber)

  *Response: The steering committee will explore this opportunity in the new round of Hiring Initiative Program in collaboration with Statistics, Mathematics and Computer Science departments.*

- Work with employers so that (maybe in lieu of tuition support), the student/employee receives time off from work to pursue the heavy schedule of the academic program.

  *Response: We will incorporate this suggestion during the implementation phase post approval.*
Appendix G

Bylaws of the MS in Business Analytics Program
Master of Science in Business Analytics Bylaws
Administrative Home: Graduate School of Management
Approved by Graduate Council: __________

ARTICLE I. OBJECTIVE

A. Purpose: The Master of Science in Business Analytics (MSBA) is organized primarily to establish and administer graduate business analytics education leading to the MSBA degree, in conformance with the rules of the Graduate Council and the Office of Graduate Studies of the Davis Campus of the University of California. The Program shall be organized as a Departmentally-based Graduate Program.

B. Discipline: The discipline of business analytics serves an important role in society by creating and disseminating scientific knowledge in the use of data and analytics to solve complex business problems, gain insights, make informed decisions, manage uncertainty, improve outcomes, and communicate effectively the problem formulation, solution, and course of actions. Business analytics professionals serve all institutions, including but not limited to for-profit companies, nonprofit organizations, and government or nongovernment organizations. They are held to a high standard of professional conduct and ethics.

C. Mission: The mission of the MSBA is to develop business leaders proficient in analytics by providing educational and research opportunities for students. The MSBA program aims to prepare students to use data and analysis to identify business opportunities and create business value. It will advance the science and practice of business analytics by bringing together faculty, students, and companies to promote research, teaching, and outreach.

ARTICLE II. MEMBERSHIP

A. Criteria for Membership in the Graduate Program

1. Disciplinary expertise, research area, and accomplishments. Membership in the graduate program will be limited to faculty associated with UCD who are qualified to
guide students through the MSBA program. Membership in the Graduate Program is separate and apart from membership in the GSM MBA program. All regular members of the Graduate School of Management with teaching appointments at UCD shall be invited to be the initial members of the graduate program. Non-departmental faculty members of the Academic Senate or Academic Federation whose appointment authorizes the direction of graduate work may be elected to membership in the graduate program.

All members of the program must hold an appropriate academic title as (a) a member of the Academic Senate of the University of California (includes Professors, Lecturers with Security of Employment, Professors in Residence, Professors of Clinical “___”, Professors Emeritus/a, and Research Professors), (b) Adjunct Professor, (c) Lecturer (without Security of Employment) or (d) Lecturer Without Salary. Academic staff with primary appointments as Cooperative Extension Specialists or in the Professional Research series are not eligible to be members of graduate programs unless they also hold an appropriate instructional title (normally Lecturer without Salary). See

2. Active research appropriate to the discipline encompassed by the program.
Members must have an active interest in Business Analytics and be engaged in an active research agenda that meets the expectations of the University of California in order to provide appropriate guidance to graduate students. Any faculty from departments other than the Graduate School of Management who wish to participate as members are required to have an active or relevant research program or expertise in methods and models applicable to business processes and functions or other closely related domains.

3. Voting rights, per Graduate Council policy and Academic Senate Rule 55. All active members are eligible to vote on graduate matters; however, Emeritus faculty and members from departments other than the Graduate School of Management may participate in MSBA matters and will not have voting rights on other matters related to the GSM or MBA.

B. Application Process
1. **Nominations.** Interested faculty may self-nominate or faculty may be nominated by a current faculty member. A nomination will consist of a letter to the Chair or Chair Delegate of the program expressing interest in becoming a member and a copy of the applicant’s curriculum vitae.

2. **Anticipated contributions from members**

   a. Participate in the administration of the MSBA by serving on administrative committees; as a graduate adviser (not to be confused with a major professor); or as an administrative officer of the program; or as a supervisor, adviser, or facilitator of student projects.

   b. Providing graduate level instruction in addition to research instruction.

   c. Service on MSBA comprehensive examination or student projects committees.

**C. Emeritus**

A member who retires from UCD may elect to continue participation in the program by submitting an application for membership (as described above). Once membership is re-established, Emeritus may teach graduate courses as deemed appropriate by the program, and may serve on administrative and student committees. Emeritus faculty may participate and vote in MSBA matters only, and will not have voting rights on other matters related to the GSM and MBA.

**D. Verification of Continued Membership.**

The Graduate Program Committee shall review on a three year basis the entire membership. A criterion for review includes the anticipated contributions listed in the above article II.B.2.

**E. Membership Appeal Process**

1. Termination of membership is based on at least two of the following:

   a. Inactive research program
b. No teaching appointment or service to the MSBA

c. No service on student committees

2. Those whose membership is terminated or those who are denied membership will be notified in writing of the decision and given an opportunity to provide additional supporting information for the Graduate Program Committee to review for reevaluation. Applicants denied membership or members denied renewal of membership may make a final appeal to the Dean of Graduate Studies.

ARTICLE III. ADMINISTRATION

The administration of the program and its activities are vested in the Graduate Program Chair and the Graduate Program Committee.

ARTICLE IV. PROGRAM CHAIR

A. Appointment of the Chair

The Graduate Program Chair administers a departmentally-based graduate program; the Graduate Program Chair is the Dean of the Graduate School of Management. The Chair may delegate the day-to-day operations of the graduate program to a Chair Delegate. The Chair Delegate will be a senate faculty member and also be a member of the MSBA Graduate Program Group. The Dean shall notify the Office of Graduate Studies of the name of the faculty to whom they have named Chair-Delegate for the MSBA. However, even with the delegation of responsibilities, the Dean is the official, graduate program Chair.

B. Duties of the Chair. The duties of the chair include providing overall academic leadership for the program; representing the interests of the program to campus and university administrators; calling and presiding over meetings of the membership; coordinating administrative matters with the Office of Graduate Studies; coordinating course teaching assignments; nominating graduate advisers.
ARTICLE V. COMMITTEES

A. Graduate Program Committee (GPC)

The Graduate Program Committee shall provide oversight of the admissions, membership, student academic standing, educational policy, and curriculum issues of the MSBA Program.

The Graduate Program Committee shall have three voting members, two of which are elected by and from the Graduate Program membership with the third being the MSBA Program Chair. The Chair of the GPC will be the MSBA Program Chair (or their Chair-Delegate). In addition to these three voting members, there will be one non-voting ex-officio member consisting of a student representative (see Article VI below).

The GPC can form sub-committees to assist the GPC with its various duties as outlined above, and can appoint sub-committee members. Members of all such sub-committees will be current members of the Graduate Program Group, and the sub-committee will also include at least one appointed member of the Graduate Program Committee (as selected by majority vote of the GPC). When appropriate, student representatives may be appointed for one-year terms on sub-committees, as non-voting members. The Chair of any sub-committee with student members must excuse the student representatives from meetings during discussion about other students, personnel actions or disciplinary issues relating to faculty, during rankings of existing students for funding, and for disciplinary issues related to students. The head of any sub-committee shall be the appointed GPC member. The duration of a sub-committee as well as the term of any of its appointed members is at the discretion of the GPC.

Election of faculty members for the Graduate Program Committee: nomination shall be made either by e-mail or from the floor at the annual May meeting of the entire membership. Elections shall be conducted by mail or electronic-mail ballot within two weeks following the annual May meeting. Each member of the program shall vote for no more than the number of positions to be filled on a ballot provided, without weighing of
choice. Those receiving the most votes will be declared elected. Ties will be resolved by lot. Election results shall be communicated to the members of the program promptly. Elected members shall assume their duties on July 1. The Chair shall preside over all meetings of the GPC. Voting will conform to Article IX below.

ARTICLE VI. STUDENT REPRESENTATIVES

A. See GPC discussion above.

ARTICLE VII. GRADUATE ADVISOR

The Chair is responsible for student advising, along with additional advisers nominated by the Chair, and appointed by the Dean of Graduate Studies.

The general duties of an adviser include: to act as a student’s first source of academic information and provides assistance with the details of each student’s plan of study in the graduate program; to review and act on student petitions; and to review student progress towards degree objectives, and, in particular, report annually to the Office of Graduate Studies about each student’s progress toward completion of degree requirements.

Mentoring and advising guidelines can be found in the GSM Policies and Procedures, available at the website: http://gsm.ucdavis.edu/students

ARTICLE VIII. MEETINGS

Meetings of the entire MSBA membership will be held at least twice a year in October and May. The Graduate Program Chair shall call regular and special meetings of the program as deemed necessary or desirable. Three or more members can petition the Chair for additional meetings. Notification will be emailed at least five instructional days before the meeting. Faculty not on campus may participate by teleconference.
ARTICLE IX. QUORUM

A. All issues that require a vote must be:

- Voted on by 50+% of the active members, and
- Passage requires a 50+% supporting vote of the quorum.

B. Vote may be cast by online voting system, email or paper ballot, or by show of hands. Upon a request by any member, the voting will be conducted by secret ballot.

ARTICLE X. AMENDMENTS

A. Amendments to these Bylaws may be made in accordance with program’s quorum policy. All amendments and revisions must be submitted to Graduate Council for review and approval.

B. Faculty may propose amendments by petition to the Chair. The Chair may ask for revisions from the faculty who submitted proposed amendments before sending forward to the program membership for review and voting. Voting on amendments will take place two weeks after suggested amendments to the bylaws have been circulated to faculty via email or posted online. Amendments to the bylaws must be passed by at least a two-thirds majority of those voting in a mail or electronic ballot.
Appendix H

Degree Requirements in the Format of the Graduate Council
Master of Science in Business Analytics

DEGREE REQUIREMENTS

Graduate Council Approval: ______________

1) Admissions requirements

Applicants are expected to enter the program with an undergraduate degree in quantitative majors such as engineering, mathematics, statistics, econometrics, and other majors. No restrictions exist on any major, but applicants are expected to possess aptitude and appetite for quantitatively-oriented coursework and careers. Early applications are accepted before Jan 15th of the current academic year for enrollment in the next academic year’s Fall Quarter entering class. Late applications are accepted up to May 15th.

To be admitted students must meet the following requirements:

- A completed Office of Graduate Studies application.
- An undergraduate degree from an accredited institution.
- A satisfactory undergraduate grade point average (minimum 3.0)
- A satisfactory performance on GMAT (typically 550 minimum) or GRE exam, although exceptions may be made on a case-by-case basis on grade point average, pending strong relevant work experience, or other criteria.
- A satisfactory performance on Test of English as a Foreign Language (TOEFL, IELTS or PTE) exam for applicants whose primary language is not English or whose graduation is from a university at which the language of instruction was not English.
- A written exam and/or an interview (in person or video/audio call) may be required.
- A written statement of purpose and essays
- Two letters of recommendations

a) Prerequisites

In addition to the admission requirements stated above, applicants are expected to have passed the equivalent of the following UC Davis courses:

**Computing and software engineering**

- ECS 40: Software Development and Object-Oriented Programming

- ECS 60: Data Structures and Programming
  Design and analysis of data structures for a variety of applications. Trees, heaps, searching, sorting, hashing, graphs. Extensive programming.

**Mathematics**


- MAT 21B: Calculus II. Definition of definite integral, fundamental theorem of calculus, techniques of integration. Application to area, volume, arc length, average of a function, improper integral, surface of revolution.

- MAT 21C: Calculus III. Sequences, series, tests for convergence, Taylor expansions. Vector algebra, vector calculus, scalar and vector fields. Partial derivatives, total differentials. Applications to maximum and minimum problems in two or more variables. Applications to physical systems.

- MAT 22A: Linear Algebra. Matrices and linear transformations, determinants, eigenvalues, eigenvectors, diagonalization, factorization.

Statistics and probability

- STA 130A or 130 B or 141: Mathematical Statistics
  Basic probability, densities and distributions, Chebyshev’s inequality, some special distributions, sampling distributions, central limit theorem and law of large numbers, point estimation, interval estimation, confidence intervals, general linear model, least squares estimates, Gauss-Markov theorem, multiple regression. Computations to access, transform, explore, analyze data and produce results. Concepts and vocabulary of statistical/scientific computing.

- ECS 132: Probability and Statistical Modeling for Computer Science

b) **Deficiencies:** Course work deficiencies should be made up by taking equivalent courses or equivalent online certification courses by the end of the first quarter by earning a letter grade of “B” or better.

2) **MSBA Plan II.** The MSBA program follows Plan II with a **written** comprehensive examination.
3) Course Requirements

a) **Core Courses (total 40 units):** The MSBA curriculum is lock-step, and all courses are required. Detailed description of the course contents is given in Section 5. Total 40 units as shown in the table:

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Courses</th>
<th>Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>BAX 401</td>
<td>Introduction to Business Analytics</td>
<td>2</td>
</tr>
<tr>
<td>Fall</td>
<td>BAX 411</td>
<td>Problem Structuring</td>
<td>2</td>
</tr>
<tr>
<td>Fall</td>
<td>BAX 421</td>
<td>Data Management</td>
<td>2</td>
</tr>
<tr>
<td>Fall</td>
<td>BAX 431</td>
<td>Data Visualization</td>
<td>2</td>
</tr>
<tr>
<td>Fall</td>
<td>BAX 441</td>
<td>Statistical Exploration and Reasoning</td>
<td>2</td>
</tr>
<tr>
<td>Fall</td>
<td>BAX 461</td>
<td>Practicum Initiation</td>
<td>2</td>
</tr>
<tr>
<td>Winter</td>
<td>BAX 402</td>
<td>Organizational Issues in Implementing Analytics</td>
<td>2</td>
</tr>
<tr>
<td>Winter</td>
<td>BAX 422</td>
<td>Big Data</td>
<td>2</td>
</tr>
<tr>
<td>Winter</td>
<td>BAX 442</td>
<td>Advanced Statistics</td>
<td>3</td>
</tr>
<tr>
<td>Winter</td>
<td>BAX 452</td>
<td>Machine Learning</td>
<td>3</td>
</tr>
<tr>
<td>Winter</td>
<td>BAX 462</td>
<td>Practicum Elaboration</td>
<td>2</td>
</tr>
<tr>
<td>Spring</td>
<td>BAX 403</td>
<td>Organizational Effectiveness Workshop</td>
<td>2</td>
</tr>
<tr>
<td>Spring</td>
<td>BAX 423</td>
<td>Data Design and Representation</td>
<td>2</td>
</tr>
<tr>
<td>Spring</td>
<td>BAX 443</td>
<td>Analytic Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>Spring</td>
<td>BAX 453</td>
<td>Application Domains</td>
<td>3</td>
</tr>
<tr>
<td>Spring</td>
<td>BAX 463</td>
<td>Practicum Analysis</td>
<td>2</td>
</tr>
<tr>
<td>Summer I</td>
<td>BAX 464</td>
<td>Practicum Implementation</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>40</td>
</tr>
</tbody>
</table>

a. **Practicum (total 10 units).** The core courses involve 10 credit hours of teamwork on an industry-sourced project. This provides students with a hands-on learning experience. We (at the GSM) have built a lot of experience around utilizing industry-sourced projects as part of an educational curriculum, because our MBA students do this as part of their course work. We manage this by hiring a full-time staff person as Projects/Corporate Relations Director. For the MSBA program, we have funded a similar position (in addition to an Executive Director for the program). Working in conjunction with the Executive Director, the Corporate Relations Director will begin negotiating with companies, identifying projects, scoping them out, and working out appropriate contractual arrangements for sharing data, approximately nine months before the launch of the program. Moreover, we have already begun this work by having preliminary discussions with about 20-25 companies regarding the potential for industry-sourced projects. Finally, as a last-resort backup option, we will identify a publicly available large
dataset that could be used for a team project, should any team lose its contractual project. Numerous such datasets exist, relating to problems in business (e.g., Lending Club data, https://www.lendingclub.com/info/download-data.action) and public policy (http://www.cde.ca.gov/ds/sd/sd/), among other areas.

b) **Elective Courses (total 0 units).** None.

c) **Summary:** Total 40 units of courses are required, with the course load of 12 units each academic quarter. All courses are graduate courses.

4) **Special requirements:** N/A.

5) **Committees**

a) **Admissions Committee.** Once the completed application, all supporting material, and the application fee have been received, the application will be submitted to the Admissions Committee. The three voting faculty members of the Graduate Program Committee (GPC described in 5(d) below) automatically serve as the Admission Committee, with the chair elected from the participating faculty and appointed by the GPC. The committee reviews all complete files and makes recommendations for admission, which are then sent to the Dean of Graduate Studies for final approval of admission. Notice concerning admissions will be sent by Graduate Studies. Early applications are accepted before Jan 15th of the current academic year for enrollment in the next academic year’s Fall Quarter entering class. Late applications are accepted up to May 15th.

b) **Course Guidance or Advising Committee.** MSBA program is “lock-step” with all admitted students taking the same courses with an identical study plan. The three voting faculty members of the Graduate Program Committee (GPC described in 5(d) below) automatically serve as the Advising Committee, with the chair elected from the participating faculty and appointed by the GPC. The members of the Advising Committee will advise the admitted students of the study plan. The chair will submit the “Plan of Study” to the Office of the Graduate Studies every year.

c) **Thesis Committee or Comprehensive Examination Committee.** There is no thesis requirement in the MSBA program and hence there is no thesis committee or a “major professor.” The Comprehensive Examination Committee consists of three voting faculty members of the Graduate Program Committee, with the chair elected from the participating faculty and appointed by the GPC. The chair of GPC is appointed by the Dean of the Graduate School of Management. GPC Chair serves as the Graduate Adviser with signature authority on Graduate Studies’ forms.

d) **Graduate Program Committee (GPC).** GPC shall provide the oversight of the admissions, membership, student academic standing, and education policy and curriculum issues of the MSBA program. See Appendix G for Bylaws.

The Graduate Program Committee has three voting members, two of which are elected by and from the Graduate Program membership with the third being the MSBA Program Chair. The Chair of the GPC will be the MSBA Program Chair (or their Chair-Delegate). In addition to these three voting members, there will be non-voting ex-officio members
consisting of one student representative, the Executive Director of the MSBA program, the Chair of the GSM Education Policy Committee, and the Chair of the GSM Committee on Courses.

The Graduate Program Chair, upon recommendation of the program’s graduate students, will appoint a student representative to one of the above committees. The committee chair must excuse the student representative from meetings during discussion about other students, personnel actions or disciplinary issues relating to faculty or staff, during rankings of existing students for funding, and for disciplinary issues related to students. The student representative will serve one year on the committee. Students are non-voting members, however, his or her representation of student perspectives shall be taken into account by other committee members.

6) Advising Structure and Mentoring

The GPC Chair, the Executive Director of the MSBA program, along with the additional advisers nominated by the Chair and/or appointed by the Dean of Graduate Studies, and the Graduate School of Management serve as resource for information on academic requirements, policies and procedures, and registration information.

Support activities will begin via the Admitted Students Intranet prior to the students starting the program and are continued on a regular schedule throughout the program. GSM provides academic advising and assistance to students in the Graduate Student Services area. Incoming students get a comprehensive orientation to academic requirements and policies, appropriate course enrollment, monitoring of academic performance, guidance on course selection. Students with disabilities will receive appropriate assistance and accommodation. Students experiencing academic or personal difficulty are provided guidance and referrals to other services at GSM or elsewhere on campus.

The resources available for out of class assistance with course material and assignments include discussion groups run by faculty and teaching assistants and access to faculty and teaching assistants by e-mail or in person and at the offices.

Mentoring and Advising Guidelines can be found at the GSM website: http://gsm.ucdavis.edu/students.

7) Advancement to Candidacy

Every student must file an official application for Candidacy for the Degree of Master of Science after completing one-half of their course requirements and at least one quarter before completing all degree requirements; this is typically the spring quarter. The Candidacy for the Degree of Master form can be found online at: http://www.gradstudies.ucdavis.edu/forms/. A completed form includes a list of courses the student will take to complete degree requirements. If changes must be made to the student’s course plan after s/he has advanced to candidacy, the Graduate Adviser must recommend these changes to Graduate Studies. Students must have their Graduate Adviser and committee Chair sign the candidacy form before it can be submitted to Graduate
Studies. If the candidacy is approved, the Office of Graduate Studies will send a copy to: the appropriate Graduate Program Coordinator and the student. If the Office of Graduate Studies determines that a student is not eligible for advancement, the program and the student will be told the reasons for the application’s deferral. Some reasons for deferring an application include: grade point average below 3.0, outstanding “I” grades in required courses, or insufficient units.

8) **Comprehensive Examination and/or Thesis Requirements**

a) **Thesis Requirements (Plan I):** Not applicable because there is no thesis requirement in the MSBA program.

b) **Comprehensive Examination (Plan II):** Fulfillment of the Comprehensive Examination is the last requirement of the M.S. Plan II. Each student is required to take a **written** comprehensive examination once all the required courses are completed in Fall, Winter and Spring Quarters. The scope of the written exam includes all the required courses in Fall, Winter and Spring Quarters. The examination will be evaluated by two reviewers, at least one of them must be a member of the GPC or MSBA program faculty with no direct vested interest in the success of the student (e.g., the student is not the reviewer’s GSR or co-author on the project).

   i) **Timing.** The individual written examination will be held in the 10th month of the MSBA program.

   ii) **Outcome.** The Exam committee’s unanimous vote is required to pass a student. If a student does not pass the exam, the committee may recommend that the student be reexamined a second time, but only if the Graduate Adviser concurs with the committee. The second exam must take place within one quarter of the first exam. The format of the second exam is the same as that of the first exam and may include the submission of an amended version of the report. The examination may not be repeated more than once. If a student who does not pass on the second attempt, the exam committee recommends the Dean of Graduate Studies that the student be disqualified from further graduate work in the MSBA program.

Once passed, the Master’s Report Form is signed by the Graduate Adviser and then forwarded to the Office of Graduate Studies in accordance with the deadlines noted in the campus General Catalog (available online at the website of the Office of the Registrar). A student must maintain a GPA of 3.0 for the M.S. degree to be awarded. A candidate must be a registered student or in Filing Fee status at the time the program submits the form, with the exception of the summer period between the end of the Spring Quarter and the beginning of Fall Quarter. The program must file the report with Graduate Studies within one week of the end of the quarter in which the student’s degree will be conferred.
9) **Normative Time to Degree**

The MSBA is a lock-step, 10-month program.

10) **Typical Time Line and Sequence of Events**

The schedule of coursework is as follows:

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Courses</th>
<th>Description</th>
<th>Units</th>
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<td>Data Visualization</td>
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<td>Statistical Exploration and Reasoning</td>
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<td>Practicum Initiation</td>
<td>2</td>
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<tr>
<td>Winter</td>
<td>BAX 402</td>
<td>Organizational Issues in Implementing Analytics</td>
<td>2</td>
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<td>Winter</td>
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<td>Big Data</td>
<td>2</td>
</tr>
<tr>
<td>Winter</td>
<td>BAX 442</td>
<td>Advanced Statistics</td>
<td>3</td>
</tr>
<tr>
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<td>Machine Learning</td>
<td>3</td>
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<td>2</td>
</tr>
<tr>
<td>Summer I</td>
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<td>Practicum Implementation</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>40</td>
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11) **Sources of funding**

The MSBA is a self-supporting degree program and will be funded by student tuition. Since the program will be located in the GSM’s San Ramon campus, the majority of MSBA students are expected to be working professionals. Such students are expected to be either self-funded from their current job or funded by their employers.

In addition, 5% of the program revenues will be reserved for financial aid on need or merit basis. Awards will be made at any point during the admissions cycle. Once the program is approved, private donations will be solicited to help fund additional fellowships and awards for meritorious students.

Low cost government Stafford and Grad Plus loans are available to US Citizens and Permanent Residents. Stafford loans are available up to $20,500 per year, and Grad Plus and private loans are available for amounts in excess of $20,500. International students
with a US co-signer, may be eligible for private loans.

12) **PELP, In Absentia and Filing Fee status.**

Information about PELP (Planned Educational Leave), In Absentia (reduced fees when researching out of state), and Filing Fee status can be found in the Graduate Student Guide: [http://www.gradstudies.ucdavis.edu/publications/](http://www.gradstudies.ucdavis.edu/publications/)