

# NEW PROGRAM PROPOSAL

ILLINOIS INSTITUTE OF TECHNOLOGY

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*The following information is required to approve a new program. When using this template, move the cursor a little to the right of label, click to place the cursor there, and then type or paste in as much information as needed. Typing or pasting in text will move subsequent labels farther down the page. Each main section (General Information, Marketing Information, and Academic Information) begins a new page.*

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**College** Lewis College of Human Sciences

**Department:** Psychology/Social Sciences/Humanities/Stuart School of Business

**Date:** 4/20/2013( rev. 9/13/2013)

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## Approvals Required

**(1) Academic Unit Head:** Scott Morris - approved by Department of Psychology 3/28/2013

**(2) Dean:**

**(3) Other:**

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## GENERAL INFORMATION

**Program Title:** Bachelor of Science in Applied Analytics

**Program Scheduling** (*Next to the appropriate semester, click on the blank and type in the year*):

Fall  X  Spring  \_\_\_  Summer  \_\_\_

**Program Level:** Undergraduate  X  Graduate  \_\_\_

**Total Program Credit Hours:**  127

**Program Description:** *Provide a brief narrative of the program content (use as much space as needed)*

The Bachelor of Science in Applied Analytics combines training in using quantitative research methods and communicating their results.

**Program Purpose:** *Provide details on the intent of the program and its relation to other programs.*

Students pursuing a Bachelor of Science in Applied Analytics learn not only how to collect, curate, and analyze data but to communicate that data and its implications to various audiences and applications. The Bachelor of Science in Applied Analytics prepares students for the workplace and/or advanced research in statistics or fields in which knowledge of statistics is required, particularly careers in data science, market analysis, business analysis, bioinformatics, psychometrics, and public relations. Students who successfully complete the Applied Analytics degree will be able to manage and analyze data using an array of statistical approaches. Our career advising is based on the close monitoring of the types of analytics needed today and in the future.

**Program Benefits:** *State the impact of the program for students and for IIT.*

Multiple sources have identified analytics and data science as lucrative careers with thousands of openings. The Lewis College Applied Analytics program will appropriately prepare students to pursue these new careers and will provide expertise in communicating data and understanding human behavior that are lacking from analytics-like programs housed in areas of computer science and statistics.

The Applied Analytics degree highlights existing strengths across the university and particularly in Lewis College and allows IIT to swiftly enter the market for analytics-minded undergraduates.

The degree will be advised and taught by faculty members in the Lewis College of Human Sciences and the Stuart School of Business. Faculty members in both colleges currently teach undergraduate classes in the proposed core curriculum or specializations.

*Lewis College faculty working in applied analytics-related fields:* Matthew Shapiro (Public Policy Analysis & Econometrics); Libby Hemphill (Social Network Analysis, Communication); Alan Mead (Psychometrics); Kemp Ellington (Psychometrics); Ron Landis (Methodology); Scott Morris (Statistics); Mike Young (Statistics); Jennifer Miller (Social Network Analysis); Matt Bauer (Linguistics, Communication).

*Stuart School faculty working in applied analytics-related fields:* Krishna Erramilli (Program Director for Marketing Analytics and Communication); Weslyne Ashton (Environmental Economics); Siva Balasubramanian (Econometrics and Marketing Analytics); Haizhi Wang (Econometrics); Mike Gorham (Econometrics); Solomon Kang (Econometrics); Li Cai (Econometrics); Navid Sabbaghi (Optimization Expert); Liad Wagman (Microeconomics); plus adjuncts.

Eventually, this undergraduate degree could function as a co-terminal degree program with masters programs that are in existence and under development at IIT including: Masters of Science in Technology and Development Policy, Masters of Personnel and Human Resource Development (PHRD), Masters of Business Administration, Master of Science in Technical Communication and Information Design. A co-terminal degree (BS/MS in Marketing Analytics and Communication) is also a likely outcome once majors in Applied Analytics have sufficiently grown.

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## MARKETING INFORMATION

**Competitive Programs:** *Indicate other similar programs locally and nationally detail their success.*

A number of universities offer analytics degrees at the graduate level<sup>1</sup> (e.g., DePaul, Drexel, Michigan State, North Carolina State, Northwestern, Rutgers, Univ of Denver) but only a few undergraduate programs are available. They include Ferris State, Rutgers, Univ of Tennessee-Knoxville<sup>2</sup>. Other universities are reviewing or planning undergraduate Analytics programs or majors: Miami Univ<sup>3</sup>, Univ of Kentucky<sup>4</sup>.

We met with Will Krohn from IBM/SPSS to discuss the market for analytics degrees, and he agreed we have an opportunity to lead in undergraduate education. Will has done extensive research on the market at both the MS and BS levels and found great potential for growth at the BS level.

**Market Analysis:** *Detail the results of any market analysis performed; if none, provide justification for the program including (potential) employment opportunities for graduates.*

There is significant market demand for the Applied Analytics degree. The Applied Analytics degree emphasizes the knowledge and skills required for a number of bachelor's-level jobs listed on O\*NET as having high growth and high income opportunities. This is further confirmed in two landmark reports: the McKinsey Global Institute's "Big data: The next frontier for innovation, competition, and productivity" and the IBM Institute for Business Value's "Analytics: The new path to value".

In addition, the demand for analytics is currently high but will also increase in the medium term as shown in Figures 1 and 2 below. The foci of the Applied Analytics degree include those sectors with the greatest potential as presented in Figure 1: information, finance, government, and health.

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<sup>1</sup> [http://analytics.ncsu.edu/?page\\_id=4184](http://analytics.ncsu.edu/?page_id=4184)

<sup>2</sup> <http://bus.utk.edu/soms/prospective/undergrad/index.htm>

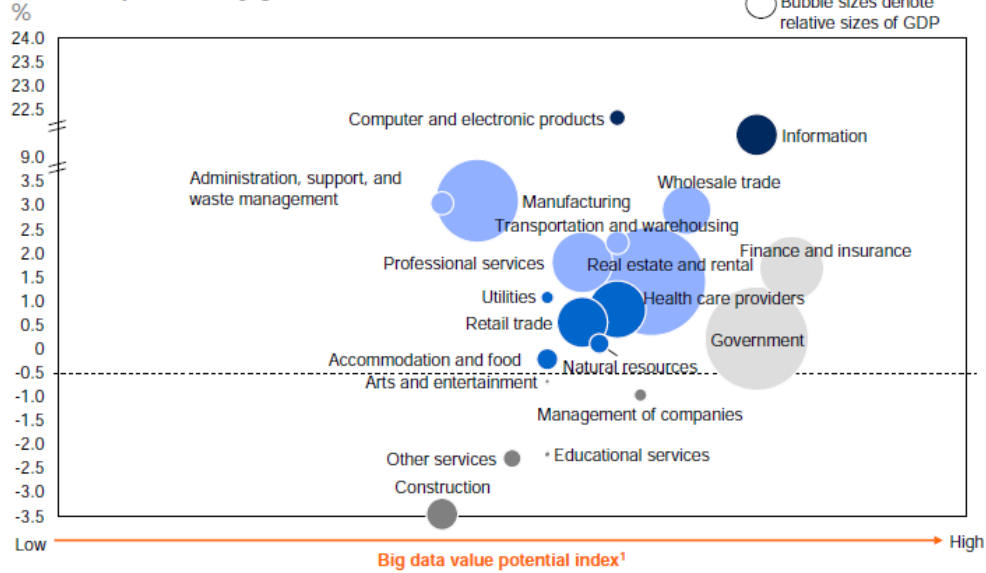
<sup>3</sup> <http://www.fsb.muohio.edu/departments/isa>

<sup>4</sup> <http://gatton.uky.edu/undergraduates/Content.asp?PageName=UDSIS>

**Figure 1**

**Some sectors are positioned for greater gains from the use of big data**

Historical productivity growth in the United States, 2000–08

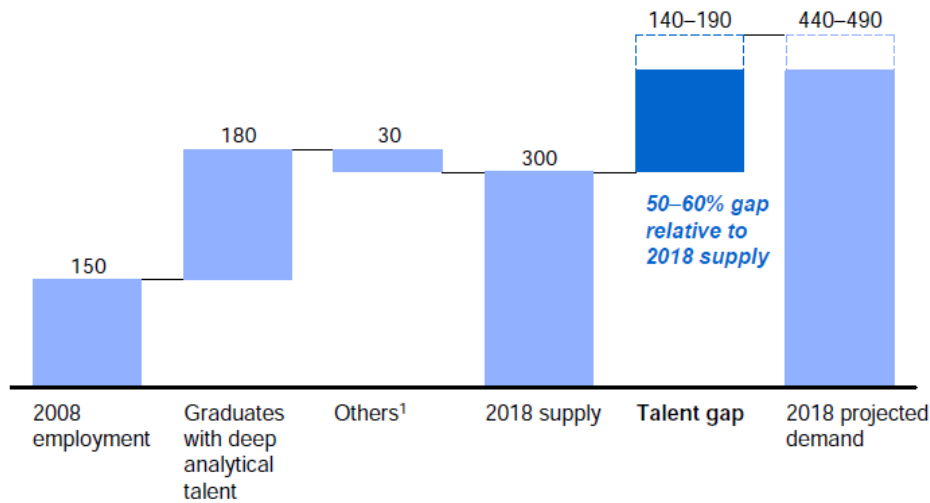


1. See appendix for detailed definitions and metrics used for value potential index.  
 SOURCE: US Bureau of Labor Statistics; McKinsey Global Institute analysis

**Figure 2**

**Demand for deep analytical talent in the United States could be 50 to 60 percent greater than its projected supply by 2018**

Supply and demand of deep analytical talent by 2018  
 Thousand people



1 Other supply drivers include attrition (-), immigration (+), and reemploying previously unemployed deep analytical talent (+).  
 SOURCE: US Bureau of Labor Statistics; US Census; Dun & Bradstreet; company interviews; McKinsey Global Institute analysis

**Marketing and Advertising:** *List the strategies to be employed for the program.*

A high priority for the university is to build programs and majors in the Lewis College of Human Sciences. Strategies for the program will be developed in consultation with the Admissions office.

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## ACADEMIC INFORMATION

**Enrollment Estimates:** *Provide estimates for initial enrollments (first three years) and for steady state including justification.*

We are targeting 25 students in the first year.

**Retention Estimates:** *Provide estimates for retention including justification.*

We expect retention rates to be on par with other departments in the college (roughly 90% retention for years 1-2).

**Course Requirements:** Proper advising is key, and advisors will be assigned to the student based on student interest (i.e., students interested in psychology-related analytics will be assigned an advisor from Psychology, students interested in business/economics-related analytics will be assigned an advisor from Stuart, and students interested in social sciences/humanities-related analytics will be assigned an advisor from Social Sciences or Humanities). Advisors will also insure that the schedule accommodates any and all prerequisites.

### Core

3 hours: Lewis College Introduction to the Professions (ITP) course

18 hours: Theory & Data (TD)

*Choose one of the following routes:*

#### Psychology

1. PSYC 203 – Undergraduate Statistics for the Behavioral Sciences
2. PSYC 204 – Behavioral Sciences
3. PSYC 221 or 222 – Human Behavior, Growth & Learning
4. PSYC 320 – Applied Correlation and Regression

#### Business/Economics

1. BUS 221 – Statistics for Managerial Decision Making
2. ECON 151 – The Economics of the Firm
3. ECON 152 – National & Global Economics
4. NEW ECON XXX – Applied Economics [course description on final page]

#### Social Sciences/Humanities

1. PSYC 203 OR BUS 221 – (see titles above)
2. PS/SOC 209 – Research Methods for the Social Sciences
3. NEW PS/SOC XXX – Advanced Statistics for the Social Sciences [course description on final page] or COM 381 Analyzing and Communicating Quantitative Data
4. COM 383 – Social Networks

*Required courses:*

- MATH 251 – Multivariate and Vector Calculus
- MATH 474 – Probability and Statistics

9 hours: Data Structures and Management (DSM)

*Choose from the following:*

- CS 331 – Data Structures (prerequisite: CS 116 OR 201)
- CS 422 – Data Mining (prerequisite: CS 331 OR 401 OR 403)
- CS 425 – Database Organization (prerequisite: CS 331 OR 401 OR 403)
- ITMD 421 – Data Modeling & Applications
- ITMD 422 – Advanced Database Management (prerequisite: ITM 421)
- ITM 428 – Database Security (prerequisite: ITM 421)

<p>12 hours: Communicating about Data (CAD)</p> <p><i>Choose from the following:</i></p> <ul style="list-style-type: none"> <li>• ITM 300 (Communication in the Workplace) OR INTM 301 (Communications for the Workplace) OR COM 421 (Technical Communication)</li> <li>• COM 424 – Document Design</li> <li>• COM 428 – Verbal &amp; Visual Communication</li> <li>• COM 430 – Intro to Web Design</li> <li>• NEW COM XXX – Information Visualization [course description on final page]</li> <li>• NEW PHIL XXX – Ethics in Data Science [course description on final page]</li> <li>• PHIL 351 – Science and Values (prerequisite: HUM 102 OR HUM 104 OR HUM 106)</li> <li>• PHIL 374 – Ethics in Computer Science (prerequisite: HUM 102 OR HUM 104 OR HUM 106)</li> <li>• ITMD 415 – Advanced Software Development (prerequisite: ITM 411 OR ITMD 411)</li> <li>• EG 425 – Computer Graphics for Non-engineers (prerequisites: EG 225 AND EG 325)</li> </ul> <p>3 hours: Lewis College Capstone course</p>	<b>Total Hours 45</b>
<p><b>Mathematics</b></p> <p>MATH 151 AND 152</p>	<b>Total Hours 10</b>
<p><b>Computer Science</b></p> <p>All students should take CS 115 AND 116 but CS 105 AND 201 are also options.</p>	<b>Total Hours 4</b>
<p><b>Natural Sciences</b></p> <p>General Education Guidelines</p> <p>2 different sciences, 2 from same discipline</p>	<b>Total Hours 11</b>
<p><b>Humanities and Social Sciences</b></p> <ol style="list-style-type: none"> <li>1. Humanities (3)(3)(3): Courses that fulfill this requirement are marked with an (H) in the bulletin. Nine credits must be distributed as follows: 1 HUM 100-level course, 2 courses marked with (H) at the 300-level or above.</li> <li>2. Social Science (3)(3)(3): Courses that fulfill this requirement are marked with an (S) in the bulletin. Nine credits must be distributed as follows: 1 course at 300-level or above, 2 courses in a single field, courses must be chosen from two different fields.</li> <li>3. Humanities or Social Science Elective (3)</li> <li>4. Cannot count toward major</li> </ol>	<b>Total Hours 21</b>
<p><b>Interprofessional Projects</b></p> <p>IPRO (3)(3)</p>	<b>Total Hours 6</b>
<p><b>Free Electives</b></p> <p><i>Suggestions for Applied Analytics majors:</i></p> <ul style="list-style-type: none"> <li>• Any of the DSM or CAD options not taken for major credit</li> <li>• MATH 476 – Statistics (prerequisite: MATH 475)</li> <li>• MATH 484 – Regression and Forecasting (prerequisite: MATH 474 OR MATH 476)</li> <li>• CS 422 – Data Mining (prerequisites: (CS 331 OR CS 401) AND (CS 351 OR CS 402))</li> <li>• CS 482 – Information and Knowledge Management Systems (prerequisites: (CS 422, CS 425, AND CS 429) OR (CS 422, CS 425, AND CS 481) OR (CS 425, CS 429, CS 481))</li> <li>• COM 380 – Online Social Networks (prerequisite: HUM 102 OR HUM 104 OR HUM 106)</li> <li>• SOC 362 – Technology and Social Change (prerequisite: ANTH 200 OR PS 190-299 OR SOC 190-299)</li> <li>• SOC 422 –Complex Organizations (prerequisites: 2 courses from PS/SOC 190-299)</li> <li>• PSYC 310 – Social Psychology</li> <li>• PSYC 409 – Psychological Testing (prerequisites: PSYC 203, PSYC 221, AND PSYC 222)</li> </ul>	<b>Total Hours 30</b>
<b>Total Hours to be Completed 127</b>	

## SAMPLE CURRICULUM /PROGRAM REQUIREMENTS

*Provide below a sample curriculum and the program requirements, as they would appear in the IIT Undergraduate Programs bulletin or Graduate Programs bulletin as appropriate.*

### Course Plan: Applied Analytics

Semester 1		Semester 2	
Lewis ITP	3	TD Required #1 (see routes above)	3
MATH 151 Calculus I	5	MATH 152 Calculus II	5
CS 115 Object-Oriented Programming I	2	CS 116 Object-Oriented Programming II	2
BIOL 107 General Biology	3	BIOL 115 Human Biology	3
Humanities 100-level elective	3	Social Sciences 200-level elective	3
Total	16	Total	16
Semester 3		Semester 4	
TD Required #2 (see routes above)	3	TD Required #3 (see routes above)	3
MATH 251 Multivariate and Vector Calculus	3	DSM Elective #1	3
Humanities or Social Sciences elective	3	CAD Elective #1	3
PHYS 211 Basic Physics I	3	Humanities or Social Sciences elective	3
Free elective	3	PHYS 212 Basic Physics II	3
Free elective	3	Free elective	3
Total	18	Total	18
Semester 5		Semester 6	
MATH 474 Probability and Statistics	3	TD Required #4 (see routes above)	3
DSM Elective #2	3	DSM Elective #3	3
CAD Elective #2	3	CAD Elective #3	3
IPRO #1	3	IPRO #2	3
Free elective	3	Humanities or Social Sciences elective	3
Total	15	Total	15
Semester 7		Semester 8	
CAD Elective #4	3	Lewis Capstone	3
Humanities or Social Sciences elective (300+)	3	Humanities or Social Sciences elective (300+)	3
Free elective	3	Free elective	3
Free elective	3	Free elective	3
Free elective	3	Free elective	3
Total	15	Total	15

**Total credit hours 128**

*Note: Total credit hours in the course plan exceed Applied Analytics requirements. To facilitate scheduling for Applied Analytics majors while adhering to general education requirements, four science courses (and no lab sections) are scheduled.*

## ECONOMIC ANALYSIS

This degree program can be established in the short term with very few resources. Most of the courses are currently taught or can be taught by an existing faculty member.

## **New course descriptions:**

- 1) *NEW ECON XXX – Applied Economics*: This course introduces the student to basic methods of econometric analysis. There are two main objectives. Students will first be introduced to theories and topics of econometrics, covering OLS and violations of the OLS assumptions (endogeneity, heteroskedasticity, non-linearity), time series, maximum likelihood, binary response models, and method of moments. Students will also have a direct, hands-on project using economic data and applying the econometric models. Students will be exposed to multiple software packages to facilitate their analysis.
- 2) *NEW PS/SOC XXX – Advanced Statistics for the Social Sciences*: This course will provide students with a broad understanding of how quantitative analysis can be applied to study of key political and social variables. Building on students' existing knowledge of statistics and social science research methods, this course will focus the students' knowledge on multiple regression analysis with special attention to moderated terms, logit and probit-based analyses, experimental analysis, and the use of instrumental variables to control for endogeneity. The primary software used in this course will be STATA, which is increasingly user-friendly and powerful.
- 3) *NEW COM XXX – Information Visualization*: This course covers theories and applied methods of information visualization. Students will work with commercial and open-source tools for creating charts, maps, and 2- and 3-D models. Students will also examine data and information visualization as part of a broader persuasive strategy (e.g., for inclusion in reports and other static materials) and for interactive manipulation, where visualization serves as a research and discovery tool. The course will conclude by looking at HTML5-based strategies for crowd-sourcing gamified visualization methods, in the spirit of the Foldit protein-folding project.
- 4) *NEW PHIL XXX – Ethics in Data Science: Description forthcoming.*