New Course Proposal: ITEC-621 Predictive Analytics

- **Academic Unit:** KSB
- **Teaching Unit:** Information Technology
- **Course Title:** Predictive Analytics
- **Course Number:** ITEC-621
- **Credit Hours:** 3
- **Proposed effective date:** Fall 2015

- **Prerequisites:** ITEC-610 Applied Managerial Statistics

- **Course description for University Catalog:**

  *In this course, students are introduced to predictive modeling methods, approaches and tools. Students develop skills in predictive analytics that will allow them to: (1) develop and use advanced predictive analytics methods; (2) develop expertise in the use of popular tools and software for predictive analytics; (3) learn how to develop predictive analytics questions, identify and select the most appropriate predictive analytics methods and tools, apply these methods to answer the respective questions and presenting data-driven solutions.*

- **Grade type:** (choose one)
  
  - [X] A/F
  - Pass/Fail
  - A/F and Pass/Fail

- **Expected frequency of offering:** (choose one)
  
  - Every Fall or Every Spring, depending on revised FT MBA curriculum
Check all that apply:  NONE

- General Education course
- Online course
- Hybrid course
- Rotating topics course
- Individually supervised course such as Internship, Independent Study, Research Course, Thesis, Dissertation
- Research methods course
- AU Abroad Program course
- Other study abroad course (offered directly by Academic Unit, not through AU Abroad)

Please explain the main purpose of the new course, including whether it will be a requirement for an existing or proposed program or an elective, and how the new course relates to the existing courses in the program and department. Note: if a required course for an existing program, submit a corresponding Minor Change to Program proposal.

This course is proposed to be a required course for the MS in Analytics program, but it can also be an elective for other graduate programs

The need for such a course in the core curriculum is explained below:

On March 29 the Obama administration unveiled a $200 million R&D big data initiative in recognition of the fact that our ability to extract knowledge and meaning out of large and complex collections of digital data can help solve some of the most pressing national problems. According to a report by Gartner, “business intelligence, analytics and performance measurement ...filter vast and growing amounts of information to reach insights and decisions in the digitized world, which is transforming industry after industry.” A recent article by the NY Times discussed how Target revenues grew $23 billion in an eight year period in which they adopted predictive analytics practices to analyze customer purchase patterns and better estimate future sales of specific items. At a recent featured speaker series at the Kogod School of Business, Laura Evans, Chief Experience Officer at the Washington Post gave a talk titled “The Future is Data: Decision-Making Shouldn’t be Done Without It.” In February of 2012, a NY Times article reported that the McKinsey Global Institute projected that the US needs 140,000 to 190,000 more workers with deep analytical expertise and 1.5 million more data-literate managers. A McKinsey 2011 quarterly report stated that “large-scale data gathering and analytics are quickly becoming a new frontier of competitive differentiation.” IBM reports that between 2005 and 2010 they invested over $14 billion in over 24 acquisitions to expand their analytics capabilities and projects $16 billion in related revenues by 2015.

These and many other stories provide conclusive evidence that we have entered the age of analytics and big data. Organizations, whether commercial, non-for profit, institutional, government or educational need to embrace this trend or run the risk of irrelevance. Many universities are now implementing educational and research programs on analytics and big data
in recognition that this is a key educational area for the foreseeable future. UVA’s recent survey of 189 schools (339 professors) found that 59 of them offer programs on analytics, big data, or business intelligence. Also, most of these schools have increased offerings since 2010. The top skills identified by this study are about data and quantitative skills. They also found that students enroll in these classes because they find them interesting. Today’s business professional must master analytics, big data, and business intelligence. We are already facing competition in this area in our local market. Both GW and GMU are ramping up substantial programs in these areas. We need to have strong course offerings in analytics or run the risk of losing relevance in the next few years.

The proposed Predictive Analytics course is an important component in analytics education and a good complement to ITEC 610 Applied Managerial Statistics and ITEC 620 Business Insights from Analytics, which provides a step into providing our students with knowledge and skills in managing, manipulating, and analyzing data to enhance decision making.

- Will the course require that students pay a special fee associated with the course? If so, please provide a justification for this additional cost to students.

None.

- Has the course previously been offered under a rotating topics course or an experimental course number? If so:

No. This is a new course.

  o Semesters/year offered: N/A
  o Course number:   N/A
  o Instructor:     N/A
  o Enrollment:     N/A
  o What observations and conclusions were derived from the previous offering(s) that now lead to proposing this course as a permanent part of the curriculum? N/A

- Please indicate other units that offer courses or programs related to the proposed course and provide documentation of consultations with those units.

There are no comparable courses on campus that we are aware of.

- Estimated enrollment per semester

  25 students, initially, increasing thereafter

- Does your teaching unit’s classroom space allotment support the addition of this course? Yes.

- Are present university facilities (library, technology) adequate for the proposed course? Yes.
Will the proposed course be taught by full-time or part-time faculty?

*As a required course, this course may be taught by both full-time and part-time faculty.*

Will offering the new course involve any substantial changes to the scheduling of existing courses?

*No.*

What are the learning outcomes including the competencies that students are expected to demonstrate for the course and how are those outcomes assessed?

*After completing this class, the student will develop the following competencies.*

**Competency-1: Predictive Analytics Methods**

1. The student will apply specific statistical and regression analysis methods to identify new trends and patterns, uncover relationships, create forecasts, predict likelihoods, and test predictive hypotheses.
2. The student will develop and use multiple linear regression models to identify relationships among variables and/or for forecasting.

**Competency-2: Predictive Analytics Tools**

1. The student will develop familiarity with popular tools and software used in industry for predictive analytics, such as SAS Enterprise Guide, SAS Enterprise Miner and IBM SPSS Modeler.
2. Because of the popularity of MS Excel in business, the students will learn how to run some of the models learned in the course using MS Excel functions and add-on tools.

**Competency-3: The Predictive Analytics Cycle**

1. Analytics is not just about math, statistics and tools, but more importantly, about learning how to formulate business questions that can be answered through predictive analytics. The student will learn how to formulate such questions.
2. The student will also learn how to select the appropriate method for predictive analysis, and how to build effective predictive models.
3. Student will then learn how to search, identify, gather, cleanse, and manipulate the necessary data for the analysis.
4. Finally, students will learn how to evaluate the soundness and validity of their models and how to interpret and report on results for a management audience.

The following will be used to assess the learning outcomes.

- Hands-on exercises
- Assignments
- In-class tests
- Course project

*Please attach a draft syllabus.*

*Syllabus is attached.*
Course description:

Analytics is the process of transforming data into insight for making better decisions. It involves specifying a question, problem, or decision, and finding the right answers using data. The process begins with identifying the appropriate data sources (internal or external, data format), and the appropriate models, tools, and methods for analysis. There are three primary types of analytics: “Descriptive,” which examines historical data and identifies and reports historical patterns and trends; “Predictive,” which predicts outcomes and future trends from existing data to help discover new relationships; “Prescriptive,” which formulates and evaluates new ways for a business to operate. Predictive analytics is of particular importance for business because it helps decision makers evaluate possible outcomes (e.g., revenues, profits, market share, probability of making a sale, probability of losing a client, etc.) based on other historical data predictors (e.g., marketing expenditures, quality assurance investments, sales force size, etc.). In this course, students are introduced to models, tools, and methods that are commonly used in predictive analytics. Students develop skills in predictive analytics that will allow them to: (1) develop and use advanced predictive analytics methods; (2) develop expertise in the use of popular tools and software for predictive analytics; (3) learn how to develop predictive analytics questions, identify and select the most appropriate predictive analytics methods and tools, apply these methods to answer the respective questions and presenting data-driven solutions.

Prerequisites:
ITEC-610

Learning objectives:
After completing this class, the student will develop the following competencies.

Competency-1: Predictive Analytics Methods
1. The student will apply specific statistical and regression analysis methods to identify new trends and patterns, uncover relationships, create forecasts, predict likelihoods, and test predictive hypotheses.
2. The student will develop and use multiple linear regression models to identify relationships among variables and/or for forecasting.

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**Textbook:**
A custom textbook will be used in this course. TBD

**Required reading:**
TBD

**Additional Resources, Data, and Software:**
The course work will include analysis of large data sets. These data sets will be available from the textbook publisher or will be available freely in the public domain. SAS Education Analytical Suite, SAS Enterprise Guide, SAS Enterprise Miner, SPSS Modeler, and similar commercial analytics software will be used. In addition, Microsoft Access and Microsoft Excel as well as add-on features and tool packs, such as Data Analysis, Solver, and XLMiner.

**Important Date:**
Last day to drop course without penalty is TBA.

**Grading:**

<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Weight</th>
<th>Composition</th>
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<tbody>
<tr>
<td>Assignments</td>
<td>30% (6 @ 5% eacj)</td>
<td>Individual</td>
</tr>
<tr>
<td>Exam</td>
<td>30%</td>
<td>Individual</td>
</tr>
<tr>
<td>Term project</td>
<td>25%</td>
<td>Team</td>
</tr>
<tr>
<td>Attendance, class exercises and Participation</td>
<td>15%</td>
<td>Individual</td>
</tr>
<tr>
<td>TOTAL</td>
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**Grading Legend:**
A: 93 or above; A-: 90 to less than 93;
B+: 88 to less than 90; B: 83 to less than 88; B-: 80 to less than 83;
C+: 78 to less than 80; C: 73 to less than 78; C-: 70 to less than 73;
D: C-: 60 to less than 70;
F: less than 60.
Grade Components:

1. **Assignments**: There will be six individual assignments on descriptive and predictive analytics modeling. The assignments will involve use of the software.

2. **Exam**: There one in-class exam towards the end of the semester.

3. **Predictive Analytics Term Project**: A team of students (optimally 3 or 4) will identify an organization and build models and methods to enhance data-driven decision making in this organization. Students will identify potential use of predictive analytics, formulate the problem, identify the right sources of data, analyze data, and prescribe actions to improve not only the process of decision making but also the outcome of decisions. This project will be delivered in three phases: a project proposal; a mid-term deliverable; and a final in-class presentation and a written report.

4. **Class attendance, exercises and participation**: In-class participation is measured by the ability of students to bring quality discussion into the class. This course is based on a model of active learning, with class discussions and exercises playing a central role. Students are expected to read the assigned material and to carefully prepare for all cases and exercises before coming to class and completing the required class exercises, when assigned. Students will be called upon to respond to faculty questions. Absence and lateness will reduce your participation grade.

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**Academic Integrity Code**

Academic integrity is paramount in higher education and essential to effective teaching and learning. As a professional school, the Kogod School of Business is committed to preparing our students and graduates to value the notion of integrity. In fact, no issue at American University is more serious or addressed with greater severity than a breach of academic integrity. Standards of academic conduct are governed by the University’s Academic Integrity Code. By enrolling in the School and registering for this course, you acknowledge your familiarity with the Code and pledge to abide by it. All suspected violations of the Code will be immediately referred to the Office of the Dean. Disciplinary action, including failure for the course, suspension, or dismissal, may result.

Additional information about the Code (i.e. acceptable forms of collaboration, definitions of plagiarism, use of sources including the Internet, and the adjudication process) can be found in a number of places including the University’s Academic Regulations, Student Handbook, and website at [http://www.american.edu/academics/integrity](http://www.american.edu/academics/integrity). If you have any questions about academic integrity issues or about standards of conduct in this course, please discuss them with your instructor.

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**Academic Support Services**

If you experience difficulty in this course for any reason, please don’t hesitate to consult with me. In addition to the resources of the department, a wide range of services is available to support you in your efforts to meet the course requirements.
**Academic Support Center** (x3360, MGC 243) offers study skills workshops, individual instruction, tutor referrals, and services for students with learning disabilities. Writing support is available in the ASC Writing Lab or in the Writing Center, Battelle 228.

**Counseling Center** (x3500, MGC 214) offers counseling and consultations regarding personal concerns, self-help information, and connections to off-campus mental health resources.

**Disability Support Services** (x3315, MGC 206) offers technical and practical support and assistance with accommodations for students with physical, medical, or psychological disabilities. If you qualify for accommodations because of a disability, please notify me in a timely manner with a letter from the Academic Support Center or Disability Support Services so that we can make arrangements to address your needs.

**Kogod Center for Business Communications** (x1920, KSB 101) To improve your writing, public speaking, and team assignments for this class, contact the Kogod Center for Business Communications. You can get advice for any written or oral assignment or for any type of business communication, including memos, reports, individual and team presentations, and PowerPoint slides. Hours are flexible and include evenings. Go to [http://www.kogod.american.edu/cbc](http://www.kogod.american.edu/cbc) and click on "make an appointment," visit KSB 101, or email [cbc@american.edu](mailto:cbc@american.edu). You may also call x1920.

**Financial Services and Information Technology Lab** (FSIT) (x1904, KSB T51) to excel in your course work and to maximize your business information literacy in preparation for your chosen career paths, we strongly recommend to take advantage of all software applications, databases and workshops in the FSIT Lab. The FSIT Lab promotes action-based learning through the use of real time market data and analytical tools used by business professionals in the market place. These include Bloomberg, Thomson Reuters, Argus Commercial Real Estate, Compustat, CRSP, @Risk etc. For more information, please check out the website at [Kogod.american.edu/fsit/](http://Kogod.american.edu/fsit/) or send us an email to [fsitlab@american.edu](mailto:fsitlab@american.edu).

**EMERGENCY PREPAREDNESS FOR DISRUPTION OF CLASSES**

In the event of an emergency, American University will implement a plan for meeting the needs of all members of the university community. Should the university be required to close for a period of time, we are committed to ensuring that all aspects of our educational programs will be delivered to our students. These may include altering and extending the duration of the traditional term schedule to complete essential instruction in the traditional format and/or use of distance instructional methods. Specific strategies will vary from class to class, depending on the format of the course and the timing of the emergency. Faculty will communicate class-specific information to students via AU e-mail and Blackboard, while students must inform their faculty immediately of any absence. Students are responsible for checking their AU e-mail regularly and keeping themselves informed of emergencies. In the event of an emergency, students should refer to the AU Student Portal, the AU Web site ([http://www.american.edu/emergency/](http://www.american.edu/emergency/)) and the AU information line at (202) 885-1100 for general university-wide information, as well as contact their faculty and/or respective dean’s office for course and school/ college-specific information.
COURSE OUTLINE

Week 1  Predictive Analytics Overview
        Articles by Davenport and others

Week 2  Descriptive Analytics Overview
        Overview of variable types
        Data manipulation in SAS Enterprise Guide
        Correlation analysis review
        ANOVA review
        Factor analysis review
        Data mining review

Week 3  The Predictive Analytics cycle
        Formulating predictive analytics questions
        Identifying the necessary data
        Selecting the most appropriate model
        Selecting the most appropriate tool
        Building an effective model
        Interpreting results
        The analytics report

Week 4  Predictive Analytics Modeling Review
        Simple regression analysis review
        Ordinary Least Squares (OLS) assumptions
        Multiple OLS regression analysis review
        Logistic modeling review
        Forecasting review
        Overview of various models when OLS assumptions are not met

Week 5  Analyzing Survey Data
        Factor Analysis and Principal Components
        Reliability Analysis
        Measurement Error
        Building variables from survey items
        Concurrent and predictive validity analysis
        Discriminant analysis

Week 6  Interaction Models
        Interaction with binary variables
        Interaction of two continuous variables

Week 7  Introduction to Structural Equation Models (SEM)
        Conceptual foundations
        When to use OLS for SEM
        Partial Least Squares (PLS) models
Week 8  Non-Linear Regression Models
        Variable transformations
        Log regressions
        Quadratic models
        Spline Regression
        Other non-linear models

Week 9  Exam

Week 10  Introduction to Social Network Analysis Models
         Social Network Concepts
         1-Mode and 2-Mode Networks
         Key network structural properties
         Visualization of networks
         Network clusters
         Quadratic Assignment Procedure (QAP) correlation
         Quadratic Assignment Procedure (QAP) regression

Week 11  Putting in all together
         The Predictive Analytics cycle review

Week 12  Term project review

Week 13  Predictive Analytics with Unstructured Data and Text Mining

Week 14  Visual analytics for predictive modeling

Week 15  Term project presentations