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|  | **GRADUATE SCHOOL OF ENGINEERING AND MANAGEMENT**  **Department of Operational Sciences**  **DASC 500: Introduction to Data Analytics Course Syllabus**  **Winter 2020** |

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| **Meeting Times** | On-line |
| **Location** | On-line |
| **Instructor** | Darryl Ahner, PhD. P.E.; Maj Jason Freels, PhD |
| **Office Location** | USAF Expeditionary Operations School Instructor Office |
| **Office hours** | Scheduled recitation periods |
| **Contact Information** | afitensdataanalytics@afit.edu |

**Course Description:**

This course addresses the applicability of data analytics in the Air Force and in the Department of Defense. Topics include types of data analytics, improvements that data analytics can bring, various types of applications to include familiarization with data mining and knowledge discovery common industry standards and use, an introduction to policy as it relates to ethics and proper data use, software and data documentation best practices, skills needed, and an introduction to data visualization and communication. Students will learn how to identify, select, and implement applications to solve real-world problems. The course addresses data sources along with the challenges of data access and classifications.

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| **Credits** | **4.0** |
| **Prerequisites** | **None** |

**Student Learning Objectives:**

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| 1 | Understand the field of data analytics, data analytics history, and skills required to be a successful data analyst. |
| 2 | Model a given data analysis scenario in the appropriate conceptual framework. |
| 3 | Conduct exploratory data visualization and analysis, to include resolution of data inconsistencies due to outliers and missing data. |
| 4 | Understand the types of analytics and advanced analytic techniques and their proper uses. |

**Required Books and Resource Materials:**

Various provided technical journal articles and handouts

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**Recommended/Optional Books and Resource Materials:**

Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking by Foster Provost and Tom Fawcett

Data Science (MIT Press Essential Knowledge series) by John D. Kelleher

**Grading Scheme/Policy:** Relative weights and intervals corresponding to specific letter grades are tentative and may be adjusted subject to the instructor’s discretion.

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| **Category** | **Relative Weight** |
| Homework | 30% |
| Course Journal | 40% |
| Project | 30% |

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| **Percentage of Points Earned** | **Letter Grade** |
| 96% and above | A |
| [93%, 96%) | A- |
| [90%, 93%) | B+ |
| [86%, 90%) | B |
| [83%, 86%) | B- |
| [80%, 83%) | C+ |
| [76%, 80%) | C |
| [73%, 76%) | C- |
| [70%, 73%) | D+ |
| [67%, 70%) | D |
| [65%, 67%) | D- |
| [0%, 65%) | F |

**AFIT Policies:**

1. **Attendance:** Attendance at all class sessions and exams is mandatory for military and civilians assigned to AFIT as full-time students except for extenuating circumstances. Scheduled classes and exams are defined by the instructor and they are documented in the course schedule. Part-time students are expected to attend scheduled classes, and absences should be explained to the instructor. The student should provide advance notice, if possible. (References: Student Handbook, Graduate School Catalog)
2. **Academic Integrity:** All students must adhere to the highest standards of academic integrity. Students are prohibited from engaging in plagiarism, cheating, misrepresentation, or any other act constituting a lack of academic integrity. Failure on the part of any individual to practice academic integrity is not condoned and will not be tolerated. Individuals who violate this policy are subject to adverse administrative action including disenrollment from school and disciplinary action. Individuals subject to the Uniform Code of Military Justice may be prosecuted under it. Violations by government civilian employees may result in administrative disciplinary action without regard to otherwise applicable criminal or civil sanctions for violations of related laws. (References: Student Handbook, ENOI 36 – 107, *Academic Integrity*)
3. **Academic Grievance:** AFIT and the Graduate School of Engineering and Management affirm the right of each student to resolve grievances with the Institution. Students are guaranteed the right of fair hearing and appeal in all matters of judgment of academic performance. Procedures are detailed in ENOI 36 – 138, *Student Academic Performance Appeals*.

**Course-Specific Policies:**

1. **Testing Policy:** In-class quizzes and examinations are closed book and closed notes unless otherwise specifically designated by the instructor. All graded events are individual efforts unless specific guidance from the instructor states otherwise.
2. **Late Assignments and Make-Ups:** As a general rule, late work will not be accepted without prior coordination from the student. Exceptions may be made on a case by case basis.
3. **Homework:** Homework is an individual effort with a twofold purpose. The first purpose is to provide the student with the opportunity to gain, improve, and sustain proficiency in course content. The second purpose is to provide the instructor with the opportunity to assess student understanding and proficiency in course content. Discussion and collaboration is expected and encouraged, but each student’s homework submission must be entirely that student’s own work.
4. **Class Preparation.** Students are expected to read assigned readings prior to class. Select lessons may include short, topical videos as part of the required preparation material in addition to recorded lectures.

**Syllabus Schedule:**

*Course assignments, due dates and other requirements may be subject to change.*

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| **FOCUS** | **CLASS** | **TOPIC** | **READING** | **ASSIGNMENTS** |
| Introduction to Data Analytics | Week 1–session 1 | - Website, syllabus, expectations  - Introduction to topics: business analytics, decision making, types of analytical models, big data | - Data Analytics White Paper  - “A Very Short History Of Data Science” |  |
| Week 1–session 2 | - History of Data Analytics / Science  - CRISP-DM methodology overview | - “Data Science Workflow: Overview and Challenges”  - *CRISP-DM 1.0 Guide pgs 1-12* |  |
| Week 1-session 3 | - Data Analytics Example | - Development of Analytical Models of Blue Force Interactions with Improvised Explosive Device Incidents |  |
| Cross-industry standard process for data mining (CRISP-DM) | Week 2-session 1 | - CRISP-DM : Business Understanding | - *CRISP-DM 1.0 Guide pgs 13-16, 30-36, 57*  *- CRISP-BU article* |  |
| Week 2-session 2 | - CRISP-DM : Data Understanding | - *CRISP-DM 1.0 Guide pgs 17-19, 37-41, 58-59*  - Developing cyberspace data understanding | CRISP-BU inputs due |
| Week 2-session 3 | - CRISP-DM : Data Preparation | - *CRISP-DM 1.0 Guide pgs 20-22, 42-46, 60* |  |
| Week 3-session 1 | - CRISP-DM : Modeling | - *CRISP-DM 1.0 Guide pgs 23-25, 47-50, 60-61* | CRISP inputs due |
| Week 3-session 2 | - CRISP-DM : Evaluation | - *CRISP-DM 1.0 Guide pgs 26-27, 51-53, 62* |  |
| Week 3-session 3 | - CRISP-DM : Deployment | - *CRISP-DM 1.0 Guide pgs 28-29, 54-56, 62* |  |
| Visualization | Week 4-session 1 | - Data Visualization and Communication |  | CRISP formulation due |
| Statistics | Week 4-session 2 | - Descriptive Statistics |  | HW Due |
| Statistical Inference | Week 5 | - Selecting a Sample  - Point Estimation  - Interval Estimation  - Hypothesis Testing  - Big Data |  | HW Due |
| Probability | Week 6-session 1 | - Probability |  |  |
| Regression | Week 6-session 2 | - Regression (simple) |  |  |
| Advanced Analytical Techniques | Week 6-session 3 | - Neural Networks |  | HW Due |
| Week 7-session 1 | - Classification and Regression Trees |  |  |
| Week 7-session 2 | - Multiple Regression |  |  |
| Week 7-session 3 | - Example | Response Surface Modeling of Precision  Guided Fragmentation Munitions | HW Due |
| Week 8-session 1 | - Principal Component Analysis |  |  |
| Week 8-session 2 | - Functional Component Analysis |  |  |
| Data Mining Techniques | Week 8-session 3 | - Cluster Analysis |  | HW Due |
| Week 9 | PROJECT TIME | Interaction with instructor as needed  (early drafts welcome |  |
| Week 10-  session 1 | - Association Rules |  |  |
| Week 10-  session 2 | - Text Mining |  | Project Due |

The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary.