ESI 4628: Decision Support Systems for Industrial Engineers

Industrial Engineering and Management Systems Department
College of Engineering and Computer Science
University of Central Florida

COURSE SYLLABUS

Fall 2018

Instructor:	Dr. Ivan Garibay
Office:	ENG2 424
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Office Hours:	by appointment only
Teaching Assistant:	Mrs. Ramya Akula
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TA Office Hours:	Tue/Thu 9:00am-10:15am, ENG2 320
Website:	UCF Webcourses
Class Location:	ENG2 102
Credits:	3
Class Meeting Days:	Tuesdays and Thursdays
Class Meeting Hours:	10:30am-11:45am

I. Goals and Objectives

The goal of this course is to make student familiar with fundamental methods for building data-driven decision support systems with the popular programming language Python (https://www.python.org/). Basic decision support methodology will be presented alongside modern data science and machine learning techniques.

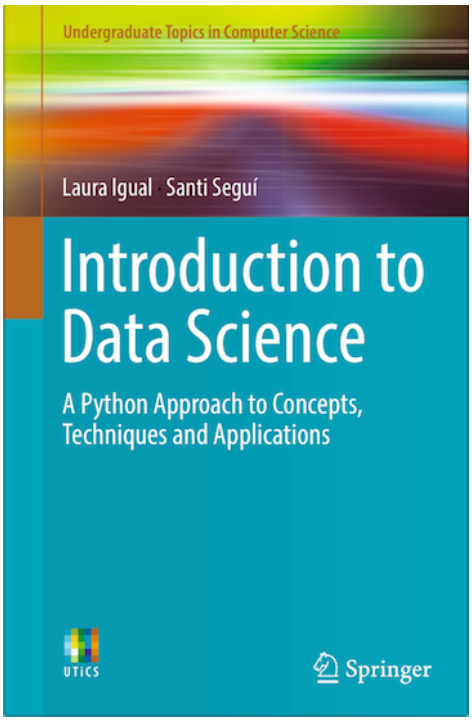
The objectives of this course are:

(1) To develop advanced programming skills using the Python programming language using the Jupyter Notebooks (http://jupyter.org) environment. By the end of the course the learner should be competent in using Python programming to manipulate data objects, ingest data, create data-driven models for decision support, and produce advanced data visualization.
(2) To use the previously learned skills to build a complete data-driven decision support system for modeling and analyzing a real-world engineering problem.

II. Course Prerequisites

- STA 3023 Probability and Statistics for Engineers
- COP 3223 High level Computer Programming

III. Required Text and Materials



Textbook:

Laura Igual and Santi Seguí, (2017). ***Introduction to Data Science: A Python Approach to Concepts, Techniques and Applications***, Undergraduate Topics in Computer Science, Springer International Publishing, Switzerland. ISBN: 978-3-319-50016-4.

Software:

Anaconda (Python 2.7 version)
https://www.anaconda.com/what-is-anaconda/
This software is free and available at:
https://www.anaconda.com/download/

The Anaconda distribution is the most popular and easiest to use data science platform on the market. Anaconda includes Python, Jupyter Notebooks, and all the software and libraries that you will need for this course. Anaconda is free to download and use and it is available for Mac, Windows and Linux operating systems.

Laptop Usage:

- All students are expected to have access to a personal computer or laptop with internet. This computer is needed to access the UCF WebCourses platform and to do the required programing homework and final project. This computer needs to have the Anaconda (Python 2.7 version) software installed.
- All the lectures will be hands on. Students are strongly encouraged to bring in their laptops and perform the programming examples along with instructor in class.
- Teaching Assistant(s) will be present at all classes and dedicated to help and support students as they follow the lectures on their Laptops.

IV. Supplemental Materials

Wes McKinney (2013). ***Python for Data Analytics: Data Wrangling with Pandas, NumPy, and IPython,*** O'Reilly Media Inc. Publishers, USA. ISBN: 978-1-440-31979-3

Jake VanderPlas (2017). ***Python Data Science Handbook***, O'Reilly Media Inc. Publishers, USA

V. Schedule

Document Version: 4.2-8.20.18								
Part	**Unit**	**Lecture**	**Week**	**Date**	**Topics Covered**	**References**	**Notebook Name (GitHub igaribay/DSSwithPython)**	**Assignments**
PART I Decision Support Tools: Python Essentials	**Unit 1: Introduction**	**Lecture 1.1**	**1**	08/21/18	DSS, Data Science, AI, Anaconda, Python	https://docs.python.org/3/tutorial/ https://www.coursera.org/learn/python-programming-introduction	DSS-Unit01-Lecture01.2018.ipynb	**Final Project and Team Selection Announcement**
		Lecture 1.2		08/23/18	Python Data Structures (Tuples, Lists, Dicts, Sets, etc.)		DSS-Unit01-Lecture02A.2018.ipynb DSS-Unit01-Lecture02B.2018.ipynb	
	Unit 2: Python Data Structures and Functions	**Lecture 2.1**	**2**	08/28/18	Functions in Python	https://docs.python.org/3/tutorial/ https://www.coursera.org/learn/python-programming-introduction	DSS-Unit02-Lecture01.2018.ipynb	HW1 Announcement
		Lecture 2.2		08/30/18	---no class--- students work on Project Proposal			
	Unit 3: Scientific Computing with Python using NumPy	**Lecture 3.1**	**3**	09/04/18	Basic NumPy	Python Data Science Handbook, Chapter 2: Introduction to NumPy	DSS-Unit03-Lecture01.2018.ipynb	**Project Proposal and Team Selection Due**
		Lecture 3.2		09/06/18	Advanced NumPy	Python Data Science Handbook, Chapter 2: Introduction to NumPy	DSS-Unit03-Lecture02.2018.ipynb	

	Unit 4: Data Analytics with Python using Pandas	**Lecture 4.1**	**4**	09/11/18	Introduction to Pandas-Series, DataFrames	Python for Data Analysis, Chapter 5: Getting Started with Pandas, pages:123-165) https://www.tutorialspoint.com/python_pandas	DSS-Unit04-Lecture01.2018.ipynb	
		Lecture 4.2		09/13/18			DSS-Unit04-Lecture02.2018.ipynb	**HW1 Due** Project Update Reminder
	Unit 5: Data Analytics: Loading, Cleaning and Preparing Data	**Lecture 5.1**	**5**	09/18/18	Data loading, Data Cleaning, and Preparation	Python for Data Analysis, Chapter 6: Data Loading Storage and File Formats, pages 153-173	DSS-Unit05-Lecture01.2018.ipynb	
		Lecture 5.2		09/20/18		Python for Data Analysis, Chapter 7: Data Wrangling: Clean, Transform, Merge, Reshape, pages 175-211	DSS-Unit05-Lecture02.2018.ipynb	
PART II Mathematical and Statistical Models	**Unit 6: Math Modeling: Graphs and Probabilities**	**Lecture 6.1**	**6**	09/25/18	Data Visualization and Group Operations	Python Data Science Handbook, Chapter 4: Visualization with Mathplotlib, pages 217-330	DSS-Unit06-Lecture01.2018.ipynb	
		Lecture 6.2		09/27/18		Python for Data Analysis, Chapter 9: Data Aggregation and Group Operations, pages 249-283	DSS-Unit06-Lecture02.2018.ipynb	
	Unit 7: Math Modeling: Linear Programming	**Lecture 7.1**	**7**	10/02/18	---no class--- students work on Project Update			
		Lecture 7.2		10/04/18	Linear Programming	https://docs.scipy.org/doc/scipy-0.18.1/reference/generated/scipy.optimize.linprog.html https://pythonhosted.org/PuLP/	DSS-Unit07-Lecture01.2018.ipynb	Project Update Due HW2 Announcement

	Unit 8: Statistical Modeling	**Lecture 8.1**	**8**	10/09 /18	Descriptive Stats	Introduction to Data Science, Chapter 3: Descriptive Statistics, pages 29-50	DSS-Unit08-Lecture01.2018.ipynb	
		Lecture 8.2		10/11 /18	Statistical Inference	Introduction to Data Science, Chapter 4: Statistical Inference, pages 51-64	DSS-Unit08-Lecture02.2018.ipynb	
PART III Machine Learning and Network Models	**Unit 9: Machine Learning Modeling, Supervised Learning**	**Lecture 9.1**	**9**	10/16 /18	Supervised Learning: SVM and Random Forest	Introduction to Data Science, Chapter 5: Supervised Learning, pages 67-96 Python Data Science Handbook (pages: 262-266, 311-330, 331-381, 405-432) Python for Data Analysis (pages: 250-264, 373-378)	DSS-Unit09-Lecture01.2018.ipynb	
		Lecture 9.2		10/18 /18			DSS-Unit09-Lecture02.2018.ipynb	**HW2 Due** Final Project Reminder
	Unit 10: Network Analysis	**Lecture 10.1**	**10**	**10/23 /18**	Network Analysis	Introduction to Data Science, Chapter 8: Network Analysis, pages 141-164	DSS-Unit10-Lecture01.2018.ipynb	
		Lecture 10.2		**10/25 /18**	Guess Lecture on Network Science: Dr. Edwin Nassiff			
	Unit 11: Machine Learning Modeling: Regression	**Lecture 11.1**	**11**	10/30 /18	Regression Analysis	Introduction to Data Science, Chapter 6: Regression Analysis, pages 97-114 Python Data Science Handbook, pages: 262-266, 311-330, 331-381, 390-396 Python for Data Analysis, pages: 250-264, 373-378	DSS-Unit11-Lecture01.2018.ipynb	
		Lecture 11.2		11/01 /18			DSS-Unit11-Lecture02.2018.ipynb	

	Unit 12: Machine Learning Modeling: Unsupervised Learning	**Lecture 12.1**	**12**	11/06/18	Unsupervised Learning	Introduction to Data Science, Chapter 7: Unsupervised Learning, pages 115-139	DSS-Unit12-Lecture01.2018.ipynb	
		Lecture 12.2		11/08/18			DSS-Unit12-Lecture02.2018.ipynb	
PART IV Student's Final Project Presentations	**Final Project Presentations**		**13**	11/13/18	Team Presentations			**Final Project Due**
				11/15/18	Team Presentations			**Final Project Due**
	Final Project Presentations		**14**	11/20/18	---no class--- Thanksgiving			
				11/22/18	Team Presentations			**Final Project Due**
	Final Project Presentations		**15**	11/27/18	Team Presentations			**Final Project Due**
				11/29/18	Team Presentations			**Final Project Due**

**Note: Projects: Sales Force Allocation, Stochastic Customer Forecasting, Projectile Motion, Critical Path Finding, Simplex Method Animation, Project of own choice(Should submit project outline). Projects focus on : Recommender Systems, Math/Statistical Modeling, Machine Learning. Team Size: 5(Cannot be changed later)

Weekly units begin each Monday throughout the semester. Reading, discussion, and assignments are listed within each Module in WebCourses. Due dates for individual assignments vary across units, so it is the student's responsibility to stay up-to-date in dates and assignments in WebCourses. All work in this class takes place within the WebCourses environment unless specifically noted otherwise in an assignment

VI. Assignments

Assignments will be individually submitted. Assignments will consist of few exercises from class material and from the textbook selected by the instructor. All assignments will be submitted via WebCourses. A solution to the homework assignment will be posted after the submission deadline. If you have question regarding your grade, please proceed in the following order:

1) check the posted solution and compare it with yours
2) If you still have questions about grading, please email the TA.
3) If your questions are not resolved, please email me with your concern.

VII. Course Project

Term Project will be submitted in groups of 5. Each group will select one project from a list of 5 projects frameworks or propose an entire new project of their own.

Each team will work on its project throughout the semester. The project deliverables include:

- Term Project update report (doc)
- Term Project final report (doc)
- Term Project final program files (excel, data, others)
- Term Project presentation and presentation document (ppt)

Each file submitted to any of the assignments must be named to include the identity of both the group and the assignment (e.g., "Group X Assignment 1.docx", "Group Y Term Project Program.xlsx"). Do not use ZIP files or any form of compressed files for submissions.

VIII. Grading

Your grade will be based on assignments, and a term project. Course grades are determined by a weighted aggregation of scores earned on each distinct components of the course, as follows:

Homework Assignment 1	20%
Homework Assignment 2	20%
Project Update	20%
Project	40%

Letter grades will be assigned based on the following conversion scheme.

Letter Grade	Numeric Grade
A	90-100
A-	87-89
B+	84-86
B	80-83
B-	77-79
C+	70-73
C	69-65
C-	65 and below

IX. Policies

1. There is no attendance taken.
2. Students are responsible for announcements and material covered in class.
3. No cell phone use in class, including voice, text, or data.
4. Laptops may be used for Python, note-taking and course related activities only. E-mail, web, and chat are prohibited in class.
5. Loud music and noisy or disruptive behaviors are not allowed.
6. Absences or late assignments do not need to be communicated to the instructor. Informing instructor of a planned late submission does not constitute approval for the late submission.
7. WebCourses discussions and e-mails are the required mechanisms for class communications
8. E-mails to the instructor should only be used where personal privacy is required and should include the following in the subject line: "ESI4628-Fall18:". Discussion posts are preferred, via the Ask Dr. Garibay thread in Canvas, to avoid having to answer large number of emails with the same or related questions.
9. UCF policies on academic integrity will be **strictly enforced** in all discussions and assignments
10. Any form of plagiarism or cheating shall result in a Failing grade in this class. **Zero tolerance**. This course utilizes *turnitin.com* plagiarism checker.

Disability

The University of Central Florida is committed to providing reasonable accommodations for all persons with disabilities. Students with disabilities who need accommodations in this course must contact the professor at the beginning of the semester to discuss needed accommodations. No accommodations will be provided until the student has met with the professor to request accommodations. Students who need accommodations must be registered with Student Disability Services, Ferrell Commons Room 132, phone (407) 823-2371, TTY/TDD only phone (407) 823-2116, before requesting accommodations from the professor.

Financial Aid Disbursements

All faculty are required to document student's academic activity at the beginning of each course. In order to document that you began this course, you must participate on-time in all scheduled assignments in Unit 1. Failure to do so will delay financial aid disbursement to which you would otherwise be entitled.

The instructor reserves the right to modify the syllabus