Strathmore UNIVERSITY

MASTER OF SCIENCE IN DATA SCIENCE AND ANALYTICS

COURSE OVERVIEW

DSA 8101: Fundamental Computing Concepts

Office Hours: TBD

Aim:
The aim of this course is to provide students with an introduction to data analytics software. Hence provide the fundamentals of the software, especially how to write Programs using Python.

Course Learning Objectives:

- Identify core aspects of programming and features of the Python language
- Understand and apply core programming concepts like data structures, conditionals, loops, variables, and functions
- Use different tools for writing and running Python code
- Design and write fully-functional Python programs using commonly used data structures, custom functions, and reading and writing to files

Contact Period: 12 weeks

Pre-requisite: None

Description:
This course introduces programming and the Python language. Students are introduced to core programming concepts like data structures, conditionals, loops, variables, and functions. This course includes an overview of the various tools available for writing and running Python, and gets students coding quickly. It also provides hands-on coding exercises using commonly used data structures, writing custom functions, and reading and writing to files. This course may be more robust than some other introductory python courses, as it delves deeper into certain essential programming topics.

Intended Audience
This course is intended for students and professionals who have minimal or no prior programming exposure. It is for motivated learners who have experience with rigorous coursework, and are looking to gain a competitive edge in advancing their career.

Course Outline

Module 1: Course Introduction, Intro to Programming and The Python Language, Variables, Conditionals, Jupyter Notebook and VS Code

Learning Objectives

- Identify core aspects of programming and features of the Python language
- Use different tools for writing and running Python code
- Understand and apply core programming concepts like data types and variables
- Write code to manipulate text
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Topics

- Introduction to Programming
- Introduction to Python
- Configuring Python and Tools
- The Python Language
- Downloading & Installing VS Code)
- Use VS Code, an industry standard IDE for writing and running Python code
- Python Scripts
- Variables
- Data Types: Strings, Integers, Objects

Module 2: Intro to Loops, and Functions

Learning Objectives

- Understand and apply core programming concepts like loops, and functions
- Define custom functions with proper documentation
- Develop a fully functional Python program with functions to analyze numbers
- Write code to process user input and do basic error checking

Topics

- Flow Control: Loops
- 'for' Loops
- 'while' Loops
- Functions in Python
- Catching Errors
- Modular Programming

Module 3: More with Lists, Strings, Tuples, Sets and Dictionaries

Learning Objectives

- Create a list to collect information as a sequence and discover list operations
- Understand and apply data structures including tuples and sets for storing an manipulating information
- Understand and apply dictionaries to manage data
- Write more advanced code to dissect text

- Create fully-functional dynamic Python programs using data structures
- Think analytically about complex problems

Topics
- Data Structures: Introduction to Lists
- Data Structures: Dictionaries
- Data Structures: Tuples
- Data Structures: Sets
- Files

Module 4: Loading, Querying, Joining & Filtering Data Using pandas and numpy

Learning Objectives
- Data Manipulation with Numpy
- Introduction to Data frames
- Write code to read and write to files
- Load and query real-world data
- Write code to group and index data
- Apply advanced filtering and indexing, and restrict data attributes
- Perform basic computations over the data

Topics
- The Numpy library
- Importing data using Pandas
- Exploring data
- Joining and slicing subsets of data
- Computations and other methods
- Write code to group and index data
- Display results in a pivot table

Module 5: Summarizing & Visualizing Data

Learning Objectives
- Display results in a pivot table
- Easily prepare and visualize data
- Understand the fundamental principles of data visualization

Topics
- Pivot tables
- Using Matplotlib
- Principles of visualization

Effort
We expect this course will take you 5 – 10 hours per week to complete, for a total of 12 weeks.

Course Schedule

Week 1 *(Course Introduction)*	• Introduction to Programming • Introduction to Python • Configuring Python and Tools • The Python Language • Downloading & Installing VS Code)
Week 2 *(Intro to Programming)*	• Use VS Code, an industry standard IDE for writing and running Python code • Python Scripts • Data Types; Strings, Integers & Objects • Variables
Week 3, 4 *(Intro to Loops)*	• Flow Control: Loops • 'for' Loops • 'while' Loops • Catching Errors
Week 5, 6 *(Functions and Classes)*	• Functions in Python • Modular Programming
Week 7 *(Data Structures)*	• Data Structures: Introduction to Lists • Data Structures: More About Lists • Data Structures: Dictionaries • Data Structures: Tuples • Data Structures: Sets •
Week 8 *(Numpy)*	• The Numpy library
Week 9, 10 *(Pandas and data exploration)*	• Importing data using Pandas • Exploring data • Joining and slicing subsets of data • Computations and other methods • Write code to group and index data • Display results in a pivot table
Week 11 *(Data Visualization)*	• Easily prepare and visualize data • Understand the fundamental principles of data visualization

Course Assessment
Continuous Assessment: 50%; Examination 50%.
HW1 – 10%
HW2 – 10%
HW3 – 10%
HW4 – 10%
HW5 – 10%

Final Exam – 50%

Core Reading Materials

1. Guttag, J. (2016). Introduction to computation and programming using Python: With application to understanding data. MIT Press. ISBN: 9780262529624.
2. James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). An introduction to statistical learning (Vol. 112, p. 18). New York: springer.
3. Tattar, P. N., Ramaiah, S., & Manjunath, B. G. (2016). A Course in Statistics with R. John Wiley & Sons.

Recommended Texts:

1. Gardener, M. (2012). Beginning R: The statistical programming language. John Wiley & Sons.
2. Pace, L. (2012). Beginning R: An introduction to statistical programming. Apress.
3. Murphy, K. P. (2012). Machine learning: a probabilistic perspective. MIT press.