DO NOT TYPE IN THIS BOX
Bulletin # : 2
Academic Year : 2023-24

FLORIDA INTERNATIONAL UNIVERSITY
UNIVERSITY CURRICULUM COMMITTEE
Proposal for a New Course

1. **School/College** College of Engineering and Computing
   Div./Dept. in Which Taught Computing and Information Sciences

2. | COP | 3 | | | 3 |
   |---|---|---|---|---|
   | Alpha Prefix | 1st Digit | Last 3 Digits | "C"-lec-lab "L"-Lab | Cr. Hrs. |

   CIP Code *(Leave this blank):*

3. **Grading Method (select one):** ■ Graded ☐ Pass/Fail

4a. **Course Title** Python Programming II

b. **Abbreviated course Title** *(for computer class schedules, transcripts)* Python Programming II
   LIMITED TO 25 Characters *(including spaces)*

5. **Statewide Course Numbering Subject Matter Area** Computer Science

6. **Catalog Description/Major Topics** *(not to exceed 200 characters including spaces)*
   College of Medicine and College of Law: Attach description not exceeding 1,000 characters including spaces.

   Object-oriented principles, handling modules, packages, and decorators, working with databases, data structures, and visualization tools. More complex Pythonic solutions for real-world challenges.

7. **Attach detailed syllabus course outline and course justification on separate page(s).**
8. **Prerequisite(s):** COP 2XXX - Python Programming I
9. **Corequisite(s):** COP 3XXX - Computational Thinking
10. **Objective(s) of Course:**

    Deepen Python proficiency with advanced concepts, focusing on object-oriented principles and real-world applications. For a complete description and course outcomes, please refer to the attached syllabus.

11. **Does this course duplicate/overlap other courses at FIU?** ■ No ☐ Yes
    If yes, please explain:

12. **What other closely related department(s) have been consulted about this course?**

13. **Is this course used for the assessment of a program or a certificate (if yes, then send a notification to assessment@fiu.edu)?** ☑ No ☐ Yes

PROPOSAL REQUESTED BY:

Faculty Contact Gregory Murad Reis (Type name) — Gregory Murad Reis (Signature) — 09 / 04 / 2023
gmuradre@fiu.edu (Email address) — 305-348-7852 (Phone number)

Chairperson (Dept./Div.) Jason Liu (Type name) — (Signature) — 10 / 16 / 2023

Chairperson (Curr. Comm.) Alex Afanasyev (Type name) — (Signature) — 10 / 17 / 2023

College/School Dean Mark Weiss, Assoc Dean (Type name) — Mark Weiss (Signature) — 10 / 20 / 2023

Submit one original form. Attach one copy of the course justification and a draft of the course syllabus for this New Course Proposal. *The syllabus should include all components on the New Course Checklist.*

Justification for Python Programming II

The BS in Data Science curriculum at Florida International University (FIU) seeks to provide students with a comprehensive understanding of data-driven methodologies and tools. As such, the inclusion of "Python Programming II" is a strategic imperative to ensure that students are well-prepared in advanced programming paradigms, especially given Python's prominence in the data science domain. This course builds upon foundational Python concepts, focusing on features and utilities of the object-oriented programming, database manipulation, and data visualization. Its emphasis on object-oriented principles and Python's vast ecosystem ensures that students are adept at designing scalable, maintainable, and efficient software solutions. Moreover, with a focus on critical libraries like pandas and matplotlib, students will be able to manage, process, and visualize large datasets effectively. As data scientists often are faced with complex challenges, the course's introduction to advanced programming constructs, recursion, and the differences between data structures and algorithm design is invaluable. Ensuring students grasp these advanced Pythonic solutions aligns perfectly with FIU's commitment to producing data scientists who are not just proficient in data analysis but are also effective programmers capable of developing software tools for a variety of real-world data challenges.

FIU | Knight Foundation School of Computing and Information Sciences

September 8th, 2023

Subject: Memorandum of Understanding between the Knight Foundation School of Computing and Information Sciences and the Department of Mathematics & Statistics regarding a new BS in Data Science

To Whom It May Concern:

The Knight Foundation School of Computing and Information Sciences (KFSCIS) is proposing a Bachelor of Science in Data Science, and the KFSCIS committee in charge of that proposal has discussed this with relevant leadership within the Department of Mathematics & Statistics (DM&S). This Memorandum of Understanding is intended to capture the content of that discussion and agreement.

1. In general, both DM&S and KFSCIS express their sincere desire to maintain collaborative, productive, collegial, and friendly relations between the units in service of providing our students with as many of the highest quality and flexible educational options as possible.

2. In view of the above, DM&S has no objection to KFSCIS creating a Bachelor of Science in Data Science. The degree name was agreed to be "Bachelor of Science in Data Science" to clearly distinguish it from the DM&S's major in Mathematical Data Science, to show that it is an approach to Data Science that emphasizes computing and information sciences, and to distinguish it from a more mathematical course of study.

3. DM&S, in general, also has no objection to KFSCIS creating new Data-Science-related courses that overlap with existing DM&S offerings, as long as those courses are named and designed in such a way as to clearly indicate the computing and information sciences focus of the offering. For example, DM&S is supportive of KFSCIS offering the following courses in their new degree: "Introduction to Data Science" and "Advanced Data Science".

4. Regardless of the above, both units agree to continue to provide to the other unit's leadership, in accordance with the usual FIU processes, any other new course proposals that overlap with courses in the other unit, for their review and consent.

5. The new degree lists several required mathematics courses. DM&S is willing to serve KFSCIS students in these courses with the understanding that resources are available to DM&S to perform this service, such as: MAS 3105 - Linear Algebra (as an alternative to MAC 2313 - Calculus III), MAD 2104 - Discrete Mathematics (as an alternative to COT 3100), and STA 3163 - Statistical Methods I, STA 3164 - Statistical Methods II, STA 4234 - Introduction to Regression Analysis, MAD 3301 - Graph Theory, MAD 3401 - Numerical Analysis, and MAD 4203 - Combinatorics for a concentration in Statistical Modeling.

6. Finally, KFSCIS had no objection to DM&S proposing a new major in 2022 focused on Mathematical Data Science inside their existing B.S. in Mathematical Sciences, homed in DM&S. DM&S will provide the details of any further new proposed courses or major which overlap with Computer Science and consult with KFSCIS in accordance with the usual FIU processes.

Louis Tebou
Chair, Department of Mathematics & Statistics

Louis Tebou
September 8, 2023

Jason X. Liu
Director, Knight Foundation School of Computing and Information Sciences

_____, 9/8/2023

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Knight Foundation School of Computing and Information Sciences

Course Title: Python Programming II **Date:** 10/16/2023

Course Number: COP 3XXX

Number of Credits: 3

Subject Area: Programming	**Subject Area Coordinator:** Janki Bhimani **email:** jbhimani@fiu.edu
Catalog Description: Object-oriented principles, handling modules, packages, and decorators, working with databases, data structures, and visualization tools. More complex Pythonic solutions for real-world challenges.	
Textbooks: Python Object-Oriented Programming: Build robust and maintainable object-oriented Python applications and libraries by Steven F. Lott, Dusty Phillips, 4th Edition. ISBN-13: 978-1801077262. Publisher: Packt Publishing. Date: July 2, 2021.	
References (for further reading):	
Prerequisites Courses: COP 2XXX - Python Programming I	
Corequisite Courses: COP 3XXX - Computational Thinking	

Type: Core Course for BS in Data Science; Elective for CS and IT Majors.

Prerequisites Topics:

1. Programming fundamentals such as control structures, basic data types and structures, functions, and object-oriented paradigm in at least one programming language.
2. Experience in solving simple computational problems using coding.

Course Outcomes:

1. **Implement** an object-oriented applications utilizing principles like objects, interfaces, inheritance, and polymorphism.
2. **Make use of** Python's module system, creating, importing, and distributing packages to enhance code reusability and manage large projects.
3. **Build** Python applications that can connect to, query, and manipulate databases, and other web services.
4. **Apply** complex algorithms and data structures to solve real-world problems.
5. **Utilize** Python libraries like pandas for data processing tasks.
6. **Visualize** data using Python's matplotlib library, producing graphs and charts.
7. **Compare** advanced programming constructs like decorators, context managers, and iterators.
8. **Identify** recursion in order to enhance problem-solving skills for both computational challenges.
9. **Differentiate** the principles and applications of data structures.
10. **Examine** the significance of the principles and applications of data structures in algorithm design and optimization.

Knight Foundation School of Computing and Information Sciences
COP 3XXX Python Programming II

Association between Student Outcomes and Course Outcomes

BS in Computing: Student Outcomes Graduates of the program will have an ability to:	Course Outcomes
1) Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.	1,2,3,4,5,6,7,8,9
2) Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.	1,2,3,4,5,6,7,8,9
3) Communicate effectively in a variety of professional contexts.	
4) Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.	
5) Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.	

Program Specific Student Outcomes	
6) Apply theory, techniques, and tools throughout the data science lifecycle and employ the resulting knowledge to satisfy stakeholders' needs. [DS]	4,5,6,9

Assessment Plan for the Course and how Data in the Course are used to assess Student Outcomes

Student and Instructor Course Outcome Surveys are administered at the conclusion of each offering, and are evaluated as described in the School's Assessment Plan: https://abet.cis.fiu.edu/

Knight Foundation School of Computing and Information Sciences
COP 3XXX Python Programming II

Outline

Topic	Number of Lecture Hours (Total: 37.5 hours = 15 weeks * 2 lectures/week * 1.25 hrs/lecture)	Outcome
1. Objects in Python 1.1. Init method 1.2. Constructors	3	1
2. Object-oriented programming II 2.1. Encapsulation and class methods 2.2. Inheritance and polymorphism	4.5	1
3. Advanced Topics in Object-oriented programming II 3.1. Abstract classes (ABC) and Interfaces 3.2. Method overloading	3.75	1
4. Modules and packages 4.1. Importing and using modules 4.2. Creating and distributing packages	3.75	7
5. Iterators and generators 5.1. Iterators and the iterator protocol 5.2. Generators and generator expressions	3	7
6. Decorators and context managers 6.1. Introduction to decorators and their usage 6.2. Creating and using context managers	3	3,4
7. Recursion, sorting, and searching in Python 7.1. Introductory topics in recursion, sorting, and searching algorithms	4.5	8
8. Data Structures 8.1. Introduction to stacks, queues, trees	3.75	4,9
9. Working with databases 9.1. Introduction to databases and SQL 9.2. Python and SQLite	4.5	3,4,5,6
10. Data processing and visualization 10.1. Introduction to data processing with pandas 10.2. Data visualization with matplotlib	3.75	6,9

Performance Measures for Evaluation

Knight Foundation School of Computing and Information Sciences
COP 3XXX Python Programming II

All assignments are assigned through the Canvas course site. The deadlines are strictly enforced. For example, if the deadline is 11:59 PM, any assignment submitted after this time is considered late. It is also each student's responsibility to submit correct files and ensure the submission is successful before the deadline. If students are unable to submit their assignment through Canvas, they will need to send a copy of their assignment to the instructor before the stated deadline. There will be three exams and each exam will be cumulative with an emphasis on the most recently covered material. Exam details will be posted on the Canvas course site (https://canvas.fiu.edu).

Assignment	Total Points	Percentage of Final Grade
Quizzes (11-Drop-1)	100 each	10%
Homework Assignments (3)	100 each	30%
Exam 1	100	20%
Exam 2	100	20%
Exam 3	100	20%
	TOTAL	100%

Letter Grade Distribution Table

Letter	Range%	Letter	Range%	Letter	Range%
A	93 or above	B	82 - 85.9	C	70 - 73.9
A-	90 - 92.9	B-	78 - 81.9	D	60 - 69.9
B+	86 - 89.9	C+	74 - 77.9	F	less than 60

Description of Possible Homework Activities

Homework 1: Object-Oriented Programming (OOP)

Description: Students are required to design a basic library management system using object-oriented programming concepts. The system should allow adding books, checking out books, and displaying all books. Implement classes for books and users, using encapsulation, inheritance, and polymorphism.

Description of Possible Rubric:

Criteria	Excellent (100)	Good (80)	Average (60)	Below Average (40)	Poor (20)	Weight
Implementation of Classes						
- 'Book' class	All required attributes are correctly implemented and function properly	Most required attributes are implemented and function properly	Some required attributes are implemented and function properly	Few required attributes are implemented and function properly	Attributes are not implemented or do not function properly	15%
- 'User' class	All required methods are correctly	Most required methods are implemented	Some required methods are implemented	Few required methods are implemented	Methods are not implemented	15%

	implemented and function properly	and function properly	and function properly	and function properly	or do not function properly	
Application of Inheritance	Effective and sophisticated use of inheritance and polymorphism	Good use of inheritance and some use of polymorphism	Basic use of inheritance and little to no use of polymorphism	Ineffective use of inheritance and no use of polymorphism	Does not use inheritance or polymorphism	20%
System Functionality	All system functionalities work perfectly	Most system functionalities work properly	Some system functionalities work properly	Few system functionalities work properly	System functionalities do not work properly	25%
Code Quality	Code is clean, well-commented, and organized	Code is mostly clean, well-commented, and organized	Code is somewhat clean, with some comments and organization	Code is not clean, with few comments and little organization	Code is messy, without comments and organization	25%

Homework 2: Modules and Data Structures

Description: Students need to implement a module that offers operations on stacks and queues. Furthermore, they'll write a test script importing this module, showcasing all its functionalities.

Description of Possible Rubric:

Criteria	Excellent (100)	Good (80)	Average (60)	Below Average (40)	Poor (20)	Weight
Module Creation	Module perfectly defines and implements both stacks and queues	Module correctly defines and implements most of the necessary features of stacks and queues	Module defines and implements basic features of stacks and queues with some errors	Module has attempted to define and implement stacks and queues but with many errors	Module does not define or implement stacks and queues correctly	20%
Stack Operations	All operations (push, pop, display) are correctly implemented and function perfectly	Most operations are correctly implemented and function properly	Some operations are implemented correctly and function with minor issues	Few operations are implemented correctly and have many issues	Operations are not implemented correctly or have critical issues	20%
Queue Operations	All operations (enqueue, dequeue, display) are correctly implemented and function perfectly	Most operations are correctly implemented and function properly	Some operations are implemented correctly and function with minor issues	Few operations are implemented correctly and have many issues	Operations are not implemented correctly or have critical issues	20%
Test Script	Script perfectly imports the module and demonstrates each	Script correctly imports the module and demonstrates most functionalities	Script imports the module and demonstrates some functionalities with minor issues	Script attempts to import the module and demonstrate functionalities but has many issues	Script does not import the module correctly or demonstrate functionalities properly	20%

	functionality correctly					
Code Quality	Code is clean, well-commented, and organized with no errors	Code is mostly clean, well-commented, and organized with minor errors	Code is somewhat clean, with some comments and organization, and few errors	Code is not clean, with few comments and little organization, and many errors	Code is messy, without comments and organization, and has critical errors	20%

Homework 3: Data Processing with Pandas and Visualization

Description: Students are provided with a dataset (e.g., CSV file). They will perform exploratory data analysis using pandas and visualize the results using matplotlib.

Description of Possible Rubric:

Criteria	Excellent (100)	Good (80)	Average (60)	Below Average (40)	Poor (20)	Weight
Data Cleaning	All missing values, outliers, and inconsistencies are perfectly handled	Most missing values, outliers, and inconsistencies are handled well	Some missing values, outliers, and inconsistencies are handled	Few missing values, outliers, and inconsistencies are handled	Missing values, outliers, and inconsistencies are not handled	20%
Data Exploration	Comprehensive insights obtained using a wide range of pandas operations	Good insights obtained using several pandas operations	Basic insights obtained using a few pandas operations	Limited insights obtained with minimal use of pandas operations	No or incorrect insights obtained using pandas operations	20%
Visualization	At least three different types of highly insightful and well-presented plots/graphs	At least three different types of good plots/graphs showcasing insights	At least three different types of basic plots/graphs showcasing insights	Less than three different types of plots/graphs or poorly presented insights	No plots/graphs or incorrect types of plots/graphs used	20%
Analysis Summary	Comprehensive and well-articulated summary of findings	Good summary with a clear presentation of most findings	Basic summary presenting some findings	Limited or unclear summary of findings	No summary or incorrect summary of findings	20%
Code and Documentation Quality	Code is perfectly readable with comprehensive comments and excellent documentation	Code is mostly readable with good comments and documentation	Code is somewhat readable with basic comments and documentation	Code is poorly organized with limited comments and documentation	Code is unreadable with no comments and lacking proper documentation	20%