AIN3005

Advanced Python Programming
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Instructor

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Course Information[1]

Term: 2023-2024 Fall Time:

Wednesday 16:30-18:20

Course Credit/ECTS: 2 + 2

Classroom: DSC01

Course Type: Face to Face

Course Objective and Learning Objectives

This comprehensive course covers a wide range of topics in Python programming. It begins with Object-Oriented Programming (OOP), introducing the concepts of classes, objects, encapsulation, inheritance, and polymorphism. The second part of the OOP module explores interfaces, OOP principles, and data abstraction. The course also delves into writing effective functions, covering function naming conventions, trade-offs in function size, and the effective use of function parameters and arguments. Functional programming is explored, including the functional programming paradigm, the itertools and functools libraries, and the implementation of the map-reduce design pattern in Python. Unit testing is covered extensively, including topics such as unit tests, test doubles, writing test cases and test suites using PyTest, and avoiding repetitious tests. File operations are discussed, focusing on text and binary I/O, file handling, and working with CSV, XML, and JSON files. Thread programming is covered, explaining the thread programming model, creating, running, and stopping threads, synchronizing threads, and exploring coroutines, threads, and asynchronous programming. The course provides an introduction to web architecture, covering software architectures, web architectures, and microservices. MongoDB programming is explored in two parts, covering NoSQL databases, data organization in MongoDB, querying and manipulating documents, scaling MongoDB, and working with MongoDB using Python. Designing and implementing RESTful services are discussed, including the REST architecture, designing RESTful services, and implementing them using FastAPI and Python. The course also covers event-driven architecture, including architectural event patterns and their implementation using Python and Apache Kafka. Lastly, the course addresses performance tuning and optimization of Python applications, covering monitoring, profiling, and tuning techniques, the timeit module, the cProfile profiler, Big-O notation and analysis, and language-level performance tips.

Objectives

Within completing this course, the student will be able to:
1. Understand the concepts of classes and objects in Python.
2. Understand the functional programming paradigm and its benefits.
3. Write effective test cases and test suites using the PyTest framework.
4. Understand the concepts of text and binary I/O in Python.

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1 It is essential that the syllabus announced at the beginning of the term is not changed except when necessary. When a requirement occurs, the curriculum can be changed by the lecturer of the course by notifying this situation in writing or verbally beforehand. It is the student's responsibility to follow the current program.

5. Understand the thread programming model in Python.
6. Understand asynchronous programming and its benefits.
7. Understand different software architectures.
8. Understand the fundamentals of NoSQL databases and MongoDB.
9. Designing and Implementing RESTful Services
10. Understand the principles of the REST architecture.
11. Gain knowledge of monitoring, profiling, and tuning Python applications.
12. Apply language-level performance tips to optimize Python applications.

Course Structure

The theoretical lectures for the course will be carried out in-class face-to-face conventional lectures.

Students are responsible for attending face-to-face sessions throughout the semester. Students who have questions can have either an online or a face-to-face meeting with the instructor during the office hours. Face-to-face and online appointments will be reserved upon approval.

Workload (Estimated)

The course will involve **extensive computer-based work** in addition to the readings. The time required for out-of-class work to be on avarage 6 hours per week.

Online Office Hours

To book a reservation for MS Teams call or face-to-face meeting, please contact me before 48 hours via the Itslearning messaging system.

Course Policy

Communication Channels and Methods:

You must use the messaging system of Itslearning for your questions outside the class hours. You must follow the announcements published on Itslearning.

Usage of Digital Tools:

The asynchronous learning materials are uploaded to the Itslearning system. The materials are chapter slides including detailed course notes, syllabus and project details. All the in-term activities including quizzes, and homeworks are given on the Itslearning system. Exam results will also be announced on Itslearning. You must install the Itslearning application to your mobile devices and use the Itslearning website (https://buei.itslearning.com) on your computer.

Assignments and Project Deadline:

You must follow the instructions and deadlines given in the project details file published on Itslearning. All submissions must be done on time. You have to upload your project report and presentation using the assignment link on Itslearning. **Please do not send your project report and presentation via e-mail**. Reports sent directly to me via e-mail or Itslearning messaging system will not be accepted.

Attendance:
Every student must attend at least 70% of the classes.

Disabled Student Support:

You can contact me directly regarding the issues that may be an obstacle for you (vision, hearing, etc.). In addition to this, there is a Disabled Student Unit in order to minimize the difficulties that our disabled students will encounter due to their disabilities and to eliminate the obstacles. You should contact this unit regarding your situation.

Oral and Written Communication Ethics:

Since you are training to become a professional Engineer, we always expect you to express yourself respectfully and cordially in your communication with your friends and with course instructor.

Privacy and Copyright:

In accordance with the Personal Data Protection Law, the courses will be recorded on the online platform within the scope of your approval and knowledge.

Note that you do not need to switch on your camera during a course.

It is forbidden to register participants (students and instructors) during the course.

Course Resources

The course resources are uploaded to the Itslearning system.
- Recommended Textbook:
  Tony Gaddis, "Starting out With Python", 4th Edition, Pearson

Grading and Evaluation

The following grading system will be applied for this course.

Assignment	Description	Scoring	Weight (%)
Homework	There are **4 Homework. There will be no make-up for a missing Homework.**	100	20
Midterm Exam	You will have a midterm exam covering the first seven weeks. The midterm exam will be given in Week#8. The exact date will be announced later. **Midterm will be given face-to-face in the classroom.**	100	20
Project	The project will be submitted at the end of the term	100	20
Final Exam	You will have a final exam covering all chapters. **Final exam will be given face-to-face in the classroom.**	100	40
TOTAL		**100**	**100**

Course Calendar

Week/Place	Course Topic	Assignments & Deadline
W1	**Object-Oriented Programming in Python (Part I)** Class and Objects Encapsulation Inheritance Polymorphism	

W2	**Object-Oriented Programming in Python (Part II)** Interface and OOP Principles Data Abstraction	
W3	**Writing Effective Functions in Python** Function Names Function Size Trade-Offs Function Parameters and Arguments	
W4	**Functional Programming in Python** Functional programming Paradiagm The itertools library The functools library Map-reduce design pattern and its possible implementation in Python	Homework 1
W5	**Unit Testing in Python using PyTest** Unit Test and Test Doubles Writing Test Case and Test Suite using pytest Writing repetitious tests	
W6	**File Operations in Python** Text and Binary I/O File Handling Working with CSV, XML, and JSON Files	Homework 2
W7	**Thread Programming in Python** Thread Programming Model Creating, Running, and Stopping Threads Synchronizing Threads Coroutines and Threads Asynchronous Programming	
W8	**MIDTERM**	
W9	**Introduction Web Architectures** Software Architectures Web Architectures MicroService Architecture	Homework 3
W10	**MongoDB Programming in Python (Part 1)** NoSQL Databases and MongoDB MongoDB and Data Organization Querying and Manipulating Documents	
W11	**MongoDB Programming in Python (Part 2)** Querying and Manipulating Documents Scaling MongoDB Working with MongoDB using Python	
W12	**Designing and implementing RESTful services** REST Architecture Design RESTful Services in REST Architecture Implementing RESTful Services using FastAPI and Python	Homework 4
W13	**Event-Driven Architecture** Architectural Event Patterns Implementing Event Patterns using Python and Apache Kafka	

		Performance Tuning and Optimization of Python Applications Monitoring, Profiling, and Tuning timeit module cProfile profiler Big-O Notation and Analysis Language Level Performance Tips	
W14			

Matters Needing Attention

- Make sure that you read all weekly course materials.
- Problem sets and their solutions will be provided.
- Participate positively in classroom activities and discussions.
- Attend the classes actively every week.
- If you have a health issue or any personal problem before or during any online exam, then you must send an Itslearning message or an email to the instructor not more than 30 minutes after the completion time of the exam.
- If you have a technical problem before or during any online exam, then you must send an Itslearning message or an email to the instructor not more than 30 minutes after the completion time of the exam.
- There will be a make-up exam for the midterm and final exams for the students with valid excuses according to BAU regulations.
- The relative grading system is used to give the proper letter grade to each student. The grades are given based on the student's score compared to the others in the class.

Academic Integrity, Cheating and Plagiarism

Hexham (2005) defines plagiarism as a planned deliberate action to deceive the reader by pretending to be someone's word or words. Academic plagiarism is also in the form of an author's use of more than four words in his own research, without using quotation marks from a written source, without a precise reference to the original source published before, or in the form of similar fraudulent behavior in scholarship-application forms he wrote to contribute to his research.

- Actions that can be defined as contrary to publication ethics in the scientific community are defined as follows.

  - plagiarism, - cheating, - paraphrasing, - fabrication and falsification of data,

  - to help copying and plagiarism, - to prevent others from accessing a source or data,

  - appearing as a writer in joint studies without contributing,

  - use of widely known / anonymous information, - no regular attribution, - self plagiarism etc.

- Not everything on the Internet is public and cannot be obtained without permission or reference.
- Studies conducted without proper reference are graded with a score of zero.
- Large amounts of manuscripts copied without being quoted will be considered plagiarism and you will be responsible.
- Please be aware that the penalties for plagiarism can range from grading homework to dropping you out of class.
- If you copied, plagiarized, or copied / pasted, do not expect the instructor of the course to write you a reference letter or to be your advisor.
- Cheating on your exams or assignments is a serious offence and can lead to disciplinary action (see ARTICLE 25 below).

- Cheating on your exams or assignments is a bad habit; it is important that engineers form good habits and character, and act ethically.
- Cheating on your exams or assignments unfairly provides you with a grade above your classmates who have worked hard for their grades; this generates social tension between classmates and brings a bad reputation to the BAU family.
- Cheating on your exams or assignments negates the goal of the course which is to prepare you to be a competent engineer.
- ***How is plagiarism penalized?***

If it is discovered that you have committed plagiarism during the course, the instructor of the course will refer to the program coordinator. Depending on the seriousness of the situation, the Program Coordinator will decide with a committee the appropriate penalty (from giving a grade of 0 to the activity, to expelling the student from the course). In any case, the student has the right to appeal.

ARTICLE 25 – (1) *In case it is found that a student has cheated or attempted to cheat, committed plagiarism or similar violations defined in the applicable disciplinary regulation in any exam, assignment or other assessment activities, a disciplinary proceeding will be brought against the student. The assessment activity in question is not assessed during the proceedings. A student who is found guilty is assigned zero points in addition to the disciplinary punishment. If the student is found innocent as a result of the disciplinary proceeding, the activity will be assessment or a make-up exam or other activity will be provided.*

You can access Bahçeşehir University and Higher Education Institution Regulations by clicking this sentence.