

INFO-I501 - Introduction to Informatics

Course Info	3 Credit Hours Room: IT 255 Each Thursday: 6:00 pm to 8:40 pm
Instructor:	Saptarshi Purkayastha
Office:	719 Indiana Avenue, WK 119
Email / Phone	saptpurk@iupui.edu / (317) 274-0439
Office Hours	By appointment
Class Schedule:	Before class: Lecture video/slides review 6:00 – 6:10 Weekly quiz 6:10 – 6:30 Assignment review 6:30 – 7:30 Lecture discussion 7:30 – 7:40 Break 7:40 – 8:40 Lab work and project work
Prerequisites:	None

COURSE DESCRIPTION

This course serves as an intensive introduction to the most central technical tools of Informatics, - Structured Query Language (SQL), data structures, optimization, data visualization, simulation models, probabilistic and statistical thinking and machine learning. The course teaches data management using SQL, processing, statistical analysis and basics of machine learning using Python.

EXTENDED COURSE DESCRIPTION

This course introduces the most central technical tools of informatics, which encompasses bioinformatics and health informatics. It will serve as an introduction to programming, as well as computational thinking using Python 3

Bioinformatics focuses on translational research that uses computational means to transform biological data into discoveries that help us better understand and improve life. Health informatics enhances human health and well-being through the use of information technology, computer science, and knowledge management to deliver more efficient and safer patient care as well as improve patient and population outcomes. Electronic health records, telemedicine applications, mobile health (m-health) applications, and clinical decision support are among the many technologies found in healthinformatics.

We will perform database management functionality, learn data analysis algorithms, understand informatics research methods, and apply quantitative research methods in the course project.

TEXTBOOKS AND PAPERS

It is suggested that students get their own copy of the textbooks. Papers, lectures slides and additional reading materials will be posted on Canvas.

GENERAL GUIDELINE TO THE SYLLABUS

Students are responsible for familiarizing themselves with the syllabus. The instructor is responsible for being responsive to the diverse needs of the enrolled students and for making necessary modifications to this syllabus, which is to be treated as a living document.

COURSE STRUCTURE

The course will use the “flipped classroom” pedagogical model, in which lecture and homework elements of the course are reversed. Lectures and textbook slides are viewed by students at home before the class session, while in-class time is devoted to exercises, projects and discussion. Throughout the semester the interrelationship between biomedical data and informatics tools will be tied directly to the broader use and relevance within bio- and health informatics. Please refer to the weekly schedule below for details.

TEXTBOOKS:

Title: Database Fundamentals
Author: Sharma, N., Perniu, L., Chong, F., R. et al.
Copyright: 2010, Edition: 1st
Publisher: IBM Canada
Chapters: 1-5
Link: http://public.dhe.ibm.com/software/dw/db2/express-c/wiki/Database_fundamentals.pdf

Title: Introduction to Computation and Programming Using Python
Author: John V. Guttag
Copyright: 2016, 2nd Edition
Publisher: The MIT Press
Chapters: 1-24
Link: <https://www.amazon.com/Introduction-Computation-Programming-Using-Python/dp/0262529629/>

SOFTWARE

- 1. phpMyAdmin** (a GUI to practice MySQL): [Online-No Cost]
phpMyAdmin is a free software tool written in PHP, intended to handle the administration of MySQL over the Web. Students will access and run queries on their database account on the school’s server using their IU Network ID.
- 2. IPython notebook:** [Workstation- No cost].
This should already be installed on the IUPUI workstations (please install if using your own laptops). Putty is used to connect to the IU-hosted server for the class to run Python programs for data processing, data munging and basic stats and probability

Principles of Graduate and Professional Learning (PGPL)

- | | |
|--|--------------------------|
| 1. Knowledge and skills mastery | <i>Major emphasis</i> |
| 2. Critical thinking and good judgment | <i>Moderate emphasis</i> |
| 3. Effective communication | <i>Some emphasis</i> |
| 4. Ethical behavior | |

Core Competencies (CC):

The following [AMIA biomedical informatics core competencies](#) are covered in the course:

- 1. Acquire professional perspective:** Summarize and explain the history and values of the discipline and its relationship to related fields while demonstrating an ability to read, interpret, and critique the core literatures.
- 2. Produce solutions:** Use the problem analysis to identify and understand the space of possible solutions and generate designs that capture essential aspects of solutions and their components

3. **Implement, evaluate, and refine:** Demonstrate an ability to carry out the solution, to assess its validity, and iteratively improve its design.
4. **Theories:** Understand and apply syntactic, semantic, cognitive, social, and pragmatic theories as they are used in biomedical informatics
5. **Representation:** Understand and apply representations and models that are applicable to biomedical data, information, and knowledge
6. **Fundamental knowledge:** Understand and gain experience applying the fundamentals of the field in the context of biomedical problems, particularly - Information documentation, storage, and retrieval; Machine learning, including data mining
7. **Procedural knowledge and skills:** For substantive problems related to scientific inquiry, problem solving, and decision making, analyze and critically evaluate solutions based on biomedical informatics approaches, particularly - Analyze, select, apply, and evaluate biomedical informatics methods

Teaching and Learning Methods

1. Active Learning (AL) – Students engage in reading, writing, discussion on class content.
2. Project-based learning (PBL) – Students on problem solving using class content.
3. Team-based learning – Students work in teams and contribute with different skills.
4. Lecture by instructor – Students study slides and watch lecture videos.

Program-level Learning Outcomes (PLO)

1. Analyze problems: Analyze, understand, abstract, and model a specific biomedical problem in terms of their data, information, and knowledge components.
2. Produce solutions: Use the analysis to identify and understand the space of possible solutions and generate designs that capture essential aspects of solutions and their components.
3. Implement, evaluate, and refine: Carry out the solution (including obtaining necessary resources and managing projects), evaluate it, and iteratively improve it.
4. Apply, analyze, and create data structures, algorithms, programming, mathematics, and statistics.
5. Apply, analyze, and create technological approaches in the context of biomedical problems.
6. Apply and evaluate methods of inquiry and criteria for selecting and using algorithms, techniques, and methods to solve substantive health informatics problems.

LEARNING OBJECTIVES:

Course objectives	AMIA FUNCTIONAL Domains	Proposed competency driven objectives	Miller's Pyramid(map)	Class activities	Assesment
1. Differentiate between research fields, theoretical concepts, epistemologies, and qualitative and quantitative methods.	F2	Student will be able to identify differences of research fields, theoretical concepts, epistemologies, and qualitative and quantitative	KNOWS	Readings, Quiz, lab, Quiz discussion, Assignment	class discussion, and class debate

		methods in biomedical studies.			
2. Analyze critically and speak publicly about field-specific scholarly research, projects executed in class, and data management issues.	F5	Student will be able to analyze critically and present field-specific scholarly research and data management issues, projects executed in class.	KNOWS HOW	Readings, Quiz, lab, quiz discussion, Assignment	Class debate, online discussions, project presentation
3. Design, implement, test, and debug extensible and modular programs involving control structures, variables, expressions, assignments, I/O, functions, parameter passing, data structures, regular expressions, and file handling.	F2	Student will be able to use basic programs concepts methods, commands in practice.	KNOWS	Readings, Quiz, lab, quiz discussion, Assignment	Quizzes, Assignments, project
4. Apply software development methodologies to create efficient, well-structured applications that other programmers can easily understand.	F9	Students will be able to apply software development methodologies to create efficient, well-structured applications that other programmers can easily understand.	KNOWS HOW	Readings, Quiz, lab, quiz discussion, Assignment	Quizzes, Assignments
5. Analyze computational complexity in algorithm development.	F2	Students will be able to analyze computational complexity in algorithm development.	KNOWS HOW	Readings, Quiz, lab, quiz discussion, Assignment	Python lab, quizzes, project
6. Investigate research questions and designs by	F2	Students will be able to investigate research questions and designs by	DOES	Readings, Quiz, lab, quiz discussion, Assignment	SQL lab, Quizzes, project

loading, extracting, transforming, and analyzing data from various sources.		loading, extracting, transforming, and analyzing data from various sources.			
7. Test hypotheses and evaluate reliability and validity.	F2	Students will be able to test hypotheses and evaluate reliability and validity.	KNOWS HOW	Readings, Quiz, lab, quiz discussion, Assignment	Python lab, quizzes, project
8. Implement histograms, classifiers, decision trees, sampling, linear regression, and projectiles in a scripting language.	F2	Students will be able to choose a implement data visualization in a scripting language	DOES	Readings, Quiz, lab, quiz discussion, Assignment	Python lab, quizzes, project
9. Decompose and simulate systems to process data using randomness.	F2	Students will be able to decompose and simulate systems to process data using randomness.	DOES	Readings, Quiz, lab, quiz discussion, assignment	Quizzes, project
10. Employ supervised and unsupervised machine learning for functional approximation and categorization.	F8	Students will be able to employ supervised and unsupervised machine learning for functional approximation and categorization.	KNOWS HOW	Readings, Quiz, lab, quiz discussion, Assignment	Quizzes

WEEKLY SCHEDULE

Week	Papers and Reading	Assessment
1	Sharma et al. (2010). Chapter 1: Databases and information models Sharma et al. (2010) Chapter 2: Relational model, relational algebra	Topic recap Quiz 1 Lab: Database types, , PhpMyAdmin Assignment 1
2	Sharma et al. (2010). Chapter 3: Conceptual data model Sharma et al. (2010). Chapter 4: Relational DB design Sharma et al. (2010). Chapter 5: Intro to SQL – till 5.2 only	Topic recap Quiz 2 Lab: relationships, DDL Assignment 2
3	Sharma et al. (2010). Chapter 5: Intro to SQL – 5.3 onwards Additional SQL function resources on Canvas	Topic recap Quiz 3 Lab: Adv SQL, Import data, DML Assignment 3
4	Guttag (2016). Chapter 2: Introduction to Python	Topic recap Quiz 4 Lab: installing IPython notebook Assignment 4
5	Guttag (2016). Chapter 3: Some simple numerical programs Guttag (2016). Chapter 4: Functions, scoping and abstraction	Topic recap Quiz 5 Project draft proposal Assignment 5 Lab:
6	Guttag (2016). Chapter 5: Structured types, mutability and higher-order functions Guttag (2016). Chapter 6: Testing and debugging	Topic recap Quiz 6 Project proposal Assignment 6 Lab:
7	Guttag (2016). Chapter 7: Exceptions and assertions Guttag (2016). Chapter 8: Classes and object-oriented programming	Topic recap Quiz 7 Assignment 7 Lab:
8	Guttag (2016). Chapter 9: A simplistic introduction to algorithmic complexity Guttag (2016). Chapter 10: Some simple algorithms and data structures	Class debate Quiz 8 Assignment 8 Lab:
9	Guttag (2016). Chapter 11: Plotting and more about classes Guttag (2016). Chapter 12: Knapsack and graph optimization problems	Topic recap Quiz 9 Assignment 9 Lab:
10	Guttag (2016). Chapter 13: Dynamic programming Guttag (2016). Chapter 14: Random walks and more about data visualization	Class debate Assignment 10 Essay: Debate review Lab:

11	Guttag (2016). Chapter 15: Stochastic programs, probability and distributions Guttag (2016). Chapter 16: Monte carlo simulation	Topic recap Quiz 10 Assignment 11 Lab:
12	Guttag (2016). Chapter 17: Sampling and confidence intervals Guttag (2016). Chapter 18: Understating experimental data Papers – on Classification rules	Topic recap Assignment 12 Lab:
13	Guttag (2016). Chapter 19: Randomized trails and hypothesis checking Guttag (2016). Chapter 20: conditional probability and Bayesian statistics Guttag (2016). Chapter 21: Lies. Damned lies and statistics	Quiz 11 Assignment 13 Lab:
14	Guttag (2016). Chapter 22: A quick look at machine learning Guttag (2016). Chapter 23: Clustering Guttag (2016). Chapter 24: Classification methods	Quiz 12 Assignment 14 Lab:
15		Project demos Project presentation

READINGS, CLASS DISCUSSIONS, and ASSIGNMENTS

As outlined above, each week students will have assigned readings from course texts and any additional reading resources that will be shared on Canvas.

Informatics. We will read material related to two languages: SQL and Python. Students with no (or little) programming background are encouraged to go through the supplementary materials (videos/manuals/ articles) that will be posted in the Resources section of Canvas.

Part One—Class participation and Debate

- 1.
2. The debate assignment will be on a theoretical/research method that is covered in class. Students have to take a pro/cons perspective and argue against the points made by other students. A summary of the debate needs to be submitted by each student of the class, like an ethnographical essay.

Part Two—Data Management

1. Weekly quizzes on the data readings and slides will be given to assess learning and comprehension. Quizzes will be available on Canvas just before the class under ‘Quizzes’ section. Each quiz will be time-limited with approx. one minute per point. Immediately following the quiz, Canvas will provide the score, indicating right and wrong answers. Quizzes will be available from 6 pm to 6:10pm on the day of the lecture and needs to be taken in class.
2. Lab assignments are practical deliverables that must be done by the next week. Questions will be made available in class during the lecture. These must be completed using phpMyAdmin or Python by Sunday 11:59pm of the following week.
3. A final project involving data collection, data storage, data extraction and data analysis will be assigned to teams of students. Work on the project is expected to begin during the second week of September. At the conclusion of the project, students will present their findings in a class presentation summarizing how they have applied the tools and techniques of Informatics in a BioHealth research project.
4. Team Evaluation of the project presentation: All teams (including the team giving the presentation) will grade the presentation using the following five parameters below. An internal peer review grade will be given by team members for their other members, to actively understand how each team member contributed to the project.

- a Goal setting and appropriate planning (20%)
- b Technical complexity and implementation (20%)
- c Research design (20%)
- d Project presentation (20%)
- e Project report (20%)

COURSE GRADE BREAKDOWN Part 1

- Peer grading.....10%
- Online engagement, discussion, class debate..... 10%
- Quizzes 15%
- Lab assignments.....25%
- Final project.....40%

Grading Scale:

A+	97 – 100	Outstanding achievement, given at the instructor’s discretion
A	93 – 100	Excellent achievement
A–	90 – 92.99	Very good performance and quality of work
B+	87 – 89.99	Good performance and quality of work
B	83 – 86.99	Modestly acceptable performance and quality of work
B–	80 – 82.99	Marginal acceptable performance and quality of work
C+	77 – 79.99	Unacceptable work (Core course must be repeated for credit)
C	73 – 76.99	Unacceptable work (Core course must be repeated for credit)
C–	70 – 72.99	Unacceptable work (Course must be repeated for credit)
D+	67 – 69.99	Unacceptable work (Course must be repeated for credit)
D	63 – 66.99	Unacceptable work (Course must be repeated for credit)
D–	60 – 62.99	Unacceptable work (Course must be repeated for credit)
F	Below 60	Unacceptable work (Course must be repeated for credit)

ATTENDANCE

1. Basic Policy

- a. All attendance and assignment deadline policies are in place to protect student educational rights, maintain grading equity, and promote team morale.
- b. Attendance shall be taken in every class. If you do not sign the attendance sheet while in class, you shall be marked absent. Signing the attendance sheet for another student is prohibited.
- c. Students are allowed a maximum of two absences. However, missing class does NOT excuse any student from weekly assignment deliverables. On the third absence, a student’s final grade will be reduced by 10-points. And on the fourth absence an additional 10-points will be subtracted from the final grade, and so on.
- d. If a student uses up their two absences, then has a serious event (forcing them to miss class), they will still receive a 10-point reduction in their grade. For this reason, we strongly recommend that students do not miss any classes, unless for unusually serious and documented reasons.

2. Administrative Withdrawal [University Policy]

- a. A basic requirement of this course is that you will participate in all class meetings and conscientiously complete all required course activities and/or assignments. Keep in touch with the instructor if you are unable to attend, participate, or complete an assignment on time.
- b. If you miss more than half of the required activities within the first 25% of the course without contacting the instructor, you may be administratively withdrawn from this course by the instructor. For example:

This course meets once per week; thus if you miss more than two classes in the first four weeks, you may be withdrawn by the instructor. Administrative withdrawal may have academic, financial, and financial aid implications. Administrative withdrawal will take place after the full refund period, and if you are

administratively withdrawn from the course you will not be eligible for a tuition refund.

- c. If you have questions about the administrative withdrawal policy at any point during the semester, please contact the instructor. See campus policy in detail here: <http://registrar.iupui.edu/withdrawal-policy.html>

ASSIGNMENT DEADLINES

1. Late Assignments

- a. All project stages and assignments have due dates and times. All late assignments (even one minute) will receive a 10% reduction on that particular assignment. Assignments later than 24 hours will receive an additional 10% reduction. Assignments later than 48 hours will receive a zero.

2. Team Responsibility

- a. If a late assignment is due to the action of one team member, the entire team will reap the negative results. Only in extreme cases, unless tangible evidence suggests otherwise, will the late assignment policy be deferred. For this reason, it is imperative that team members establish a self-monitoring system that includes regular communication via email, text or phone. If a team has a team member who is not acting responsibly, the team may petition the instructor for a solution.
- b. If a student misses class on the day of their presentation, they will need to give a separate presentation without their team at another time within one week or receive a zero for that assignment.

CODE OF CONDUCT

1. All students should aspire to the highest standards of academic integrity. Using another student's work on an assignment, cheating on a test, not quoting or citing references correctly, or any other form of dishonesty or plagiarism shall result in a grade of zero on the item and possibly an F in the course. Incidences of academic misconduct shall be referred to the Department Chair and repeated violations shall result in dismissal from the program.
2. All students are responsible for reading, understanding, and applying the *Code of Student Rights, Responsibilities and Conduct* and in particular the section on academic misconduct. Refer to *The Code > Responsibilities > Academic Misconduct* at <http://www.indiana.edu/~code/>. All students must also successfully complete the Indiana University Department of Education "How to Recognize Plagiarism" Tutorial and Test. <https://www.indiana.edu/~istd>
3. You must document the difference between your writing and that of others. Use quotation marks in addition to a citation, page number, and reference whenever writing someone else's words (e.g., following the *Publication Manual of the American Psychological Association*). To detect plagiarism instructors apply a range of methods, including Turnitin.com. <http://www.ulib.iupui.edu/libinfo/turnitin>

ACADEMIC MISCONDUCT

1. Cheating

- a. Cheating is considered to be an attempt to use or provide unauthorized assistance, materials, information, or study aids in any form and in any academic exercise or environment.

2. A student must not:

- a. Use external assistance on any "in-class" or "take-home" examination, unless the instructor specifically has authorized external assistance. This prohibition includes, but is not limited to, the use of tutors, books, notes, calculators, computers, and wireless communication devices.
- b. Use another person as a substitute in the taking of an examination or quiz, nor allow other persons to conduct research or to prepare work, without advanced authorization from the instructor to whom the work is being submitted.
- c. Use materials from a commercial term paper company, files of papers prepared by other persons, or submit documents found on the Internet.
- d. Collaborate with other persons on a particular project and submit a copy of a written report that is represented explicitly or implicitly as the student's individual work.
- e. Use any unauthorized assistance in a laboratory, at a computer terminal, or on fieldwork.

- f. Steal examinations or other course materials, including but not limited to, physical copies and photographic or electronic images.
- g. Submit substantial portions of the same academic work for credit or honors more than once without permission of the instructor or program to whom the work is being submitted.
- h. Without authorization, alter a grade or score in any way, nor alter answers on a returned exam or assignment for credit.

3. Plagiarism

- a. Plagiarism is defined as presenting someone else's work, including the work of other students, as one's own.
- b. Any ideas or materials taken from another source for either written or oral use must be fully acknowledged, unless the information is common knowledge. What is considered "common knowledge" may differ from course to course.
- c. A student must not adopt or reproduce ideas, opinions, theories, formulas, graphics, or pictures of another person without acknowledgment.
- d. A student must give credit to the originality of others and acknowledge indebtedness whenever: 1) Directly quoting another person's actual words, whether oral or written; 2) Using another person's ideas, opinions, or theories; 3) Paraphrasing the words, ideas, opinions, or theories of others, whether oral or written; 4) Borrowing facts, statistics, or illustrative material; or 5) Offering materials assembled or collected by others in the form of projects or collections without acknowledgment

4. Fabrication

- a. A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citation to the sources of information.

5. Interference

- a. A student must not steal, change, destroy, or impede another student's work, nor should the student unjustly attempt, through a bribe, a promise of favors or threats, to affect any student's grade or the evaluation of academic performance.
- b. Impeding another student's work includes, but is not limited to, the theft, defacement, or mutilation of resources so as to deprive others of the information they contain.

6. Facilitating Academic Dishonesty

- a. Any student who intentionally or knowingly helps (or attempts to helping) another student to commit an act of academic misconduct (as outlined in this syllabus) or who allows another student to use his or her work or resources to commit an act of misconduct will face immediate academic discipline.

7. Violation of Course Rules/Policies/Instructions

- a. Student are strongly encouraged to adhere to all course rules, policies, and instructions as outlined in the course syllabus, verbal/written instructions, or the course materials that are rationally related to the content of the course or to the enhancement of the learning process in the course.

OTHER POLICIES

1. **IUPUI course policies:** A number of campus policies governing IUPUI courses may be found at the following link: http://registrar.iupui.edu/course_policies.html
2. **Classroom civility:**
 - a. IUPUI nurtures and promotes "a campus climate that seeks, values, and cultivates diversity in all of its forms and that provides conditions necessary for all campus community members to feel welcomed, supported, included, and valued" (IUPUI Strategic Initiative 9).
 - b. IUPUI prohibits "discrimination against anyone for reasons of race, color, religion, national origin, sex, sexual orientation, marital status, age, disability, or [veteran] status" (Office of Equal Opportunity). Profanity or derogatory comments about the instructor, fellow students, invited speakers or other classroom visitors, or any members of the campus community shall not be tolerated. A violation of this rule shall result in a warning and, if the offense continues, possible disciplinary action.

- c. The School of Informatics and Computing holds that to maintain an effective and inclusive learning environment, it is important to be an attentive and respectful participant in lectures, discussions, group work, and other classroom exercises. Thus, unnecessary disruptions should be avoided, such as: ringing cell phones, engagement in private conversations and other unrelated activities, either face-to-face or electronically. Texting, surfing the Internet, and posting to Facebook, Twitter, or other social media during class are generally not permitted.
 - d. Students are strongly encouraged to switch their cell phones to vibrant during class time. If students receive what they believe to be an urgent call, they may quietly leave the classroom to address the matter.
3. **Bringing children to class:** To ensure an effective learning environment, children are not permitted to attend class with their parents, guardians, or childcare providers according to IUPUI policy.
 4. **Disabilities Policy:** In compliance with the Americans with Disabilities Act (ADA), all qualified students enrolled in this course are entitled to reasonable accommodations. Please notify the instructor during the first week of class of accommodations needed for the course. Students requiring accommodations because of a disability must register with Adaptive Educational Services (AES) and complete the appropriate AES-issued before receiving accommodations. The AES office is located at UC 100, Taylor Hall (Email: aes@iupui.edu, Tel. 317 274-3241). Visit <http://aes.iupui.edu> for more information.

MISSION STATEMENT & STATEMENT OF VALUES

1. The Mission of IUPUI is to provide for its constituents excellence in: Teaching and Learning; Research, Scholarship, and Creative Activity; and Civic Engagement.
2. With each of these core activities characterized by: Collaboration within and across disciplines and with the community; A commitment to ensuring diversity; and Pursuit of best practices.
3. IUPUI's mission is derived from and aligned with the principal components—Communities of Learning, Responsibilities of Excellence, Accountability and Best Practices—of Indiana University's Strategic Directions Charter.
4. IUPUI values the commitment of students to learning; of faculty to the highest standards of teaching, scholarship, and service; and of staff to the highest standards of service. IUPUI recognizes students as partners in learning. IUPUI values the opportunities afforded by its location in Indiana's capital city and is committed to serving the needs of its community. Thus, IUPUI students, faculty, and staff are involved in the community, both to provide educational programs and patient care and to apply learning to community needs through service. As a leader in fostering collaborative relationships, IUPUI values collegiality, cooperation, creativity, innovation, and entrepreneurship as well as honesty, integrity, and support for open inquiry and dissemination of findings. IUPUI is committed to the personal and professional development of its students, faculty, and staff and to continuous improvement of its programs and services.