

Undergraduate Course Outcomes

104	A1, A3, B3, C2, C3
227	A3
228	A3, B1
309	B1, B2, B3, A3
311	A3, B1
321	A1, B1, B2, C2 Students will understand tradeoffs between cost/performance and hardware/software
330	A2, C1, C2
331	A1, A2
342	A1, A3, B1, B3 The main objective is that students will have a deep, working knowledge of the functional paradigm and the key ideas used in modern programming languages. In more detail the essential objectives for this course are that students will be able to: <ul style="list-style-type: none">• Write and modify programs using a mostly-functional style. This means programming that makes effective use of the abstraction mechanisms of functional languages, such as higher-order functions (functions that take functions as arguments and return functions as results) to achieve generality and abstraction.• Write and modify programs that make effective use of data abstraction.• Modify interpreters to change or enhance their behavior so as to implement various features of programming languages such as: control flow, variables, recursion, scoping, syntactic sugars, arrays, parameter passing mechanisms, type checking, objects, classes, and inheritance.• Write programs using such features, and explain, using appropriate terminology, the user-visible behavior of such programs.• Explain, using appropriate terminology, the data structures and algorithms used in interpreters to implement such features.• Compare alternatives in the design and implementation of such features.
352	A3, B1
362	A3, B1, B3, C2, C3 The main objective is that students will be able to analyze system requirements, and create and justify object-oriented designs that meet their requirements and that are robust

and evolvable. In more detail the essential objectives for this course are that students will be able to:

- Analyze system requirements and model problem domains.
- Evaluate the quality of an analysis, and be able to explain how to improve it.
- Design and build object-oriented systems.
- Explain and justify designs based on design principles, patterns, and heuristics.
- Evaluate the quality of a design, and be able to explain how to improve it.
- Write object-oriented code to correctly implement a design.
- Be able to read and write analysis and design documentation in the Unified Modeling Language (UML).
- Be able to read and write object-oriented code, in Java, that uses subclasses, inheritance, abstract methods, subtypes, and subtype polymorphism.

363

A3, B2, C1

Students will understand the issue of largeness in information and its impact on paradigms for computer systems.

401

A3, B1, B2, B3, C1, C2

• **A3**

Through weekly lab assignments, students will gain more experience in writing good computer programs using modern language for solving assigned problems in networking, database accesses, etc.

Each student will apply the principles of software design taken in 300 level courses to develop software based on real-world requirements from scratch.

• **B1, B2, B3**

Each student will participate in a team project that is based on real-world requirements. Each team will contact a potential user to gather the user's requirements and apply knowledge and principles from other courses to produce a good solution that addresses the user's requirements. Each team will develop prototype software based on the design, test the software, and create documentation for both the design and the prototype software. As a result, students will understand the entire process of software development, realize problems that may occur during the development life cycle, improve problem solving skills, and enhance programming skills.

Students will apply the principles of project management to ensure that each critical component of the project is complete by the expected deadline. Students will gain experience to adjust the project schedule and to solve problems that arise throughout the course of the project.

• **C1, C2**

Students will work as a team to research recent developments in the application of computing technology in the business world. Each team will submit a written proposal

that describes the topic of the research. The proposal includes the outline of specific areas the team will investigate and the reference to the materials that will be used in the presentation. Each team will make a formal presentation to the class. All team members will participate in the team presentation as well as answer any questions. Each team will receive constructive feedback to improve their presentation skills in the future.

As part of the team project, each team will also present the project in class. All team members will take part in discussing different components of the project and answer any questions that arise. In addition to the formal presentation, each team will submit a written report that describes the goal of the project, the design documents, the project schedule, and the outcome of the project.

418 **A3, B1**

425 **A3, B2**

430 **A3, B2, C1**

440 **B3, A3**

Students should perceive programming in a new context, from the machine code that actually implements a high level programming language.

454 **A3**

455 **A2, A3, B1**

461 **A3, B1, B2, B3, C1, C2, C3**

- **A3**

Each student will be able to design and write programs to access relational databases using a modern programming language and a database connectivity technology such as Java programming language and JDBC.

Each student will be able to work as part of a team to design and prototype an information system from scratch. Students will develop an understanding of the process of designing, prototyping, and documenting an information system.

- **B1**

Each student will be able create database designs from textual descriptions of environments in need of creating a database.

Students will work together as a team to create an information system from scratch. The students will be responsible for coming up with an idea, developing the idea, designing a system based on the idea, interacting with potential users to verify that the system to be developed captures the requirements of the potential users, prototyping a system to realize the idea, and creating documentation for both the design and the prototype. As a result, each student will be able to work as part of a team, understand how to generate a design of an information system, and play a different role as a system analyst, a database administrator, and a database application developer during the development of the prototype.

- **B2**

Each student will understand the differences between the internal design of different database systems like DB/2, Oracle, and AS/400 both from the different approaches that can be used to realize a relational database system design and how the design differences impact the performance issues of relational database software.

Each student will be able to work as part of a team to design and prototype an information system from scratch. The student will learn to gather requirements from potential users and learn the different requirements of an information system via interaction with the potential users of the system. Through the refinement process, students will verify their conceptual design with potential users from time to time and refine the design if needed.

- **B3**

Each student will understand and use the design principles (e.g., use of normal forms and ER diagrams) for creating a good database design, where good means that the design will be lossless, preserve critical dependencies, and will balance physical and logical performance issues. The understanding of the design principles will help the students to easily adapt to the differences in software tools used to aid the design.

- **C1**

Each student will understand the principles of data retrieval and the fundamentals of dealing with external storage technologies.

Each student will understand the fundamentals of what a data model is and how that has impacted the emergence of new database systems.

Each student will understand the mathematical foundation of the relational data model and what it brings to the development of both individual database designs and relational database systems.

Each student will understand query optimization and transaction processing which will enable students to learn about the tasks as the developer of the database management software. Each student will use software tools to look at how queries are mapped to an execution plan by different database management system software. Through comparison, students will be able to choose the database management software that fits well with the user requirements.

Each student will understand how database systems have evolved as a basis to project likely future trends.

Each student will use different tools for querying relational databases. This allows students to see both the difference and the commonality between these software tools so that they will learn to adapt to frequent changes in software.

- **C2**

Each student will be part of a team that develops an information system from scratch. The requirements for the team project are designed in part to make sure that the team members are able to work together, develop team goals, research the domain of the problem area that their system is trying to solve, interact with potential users, assign tasks to individual members, document team decisions on design and implementation issues as a team, ensure that the project meets deadlines, and coding and helping each other in integrating and debugging the different parts of the program. As a result, students will gain more experience in time management, teamwork, and preparing documentation.

Each student will give a presentation that is critically reviewed and as a result he/she will learn the issues behind developing and presenting a good talk. Each student will write a report that documents the problem being addressed, the design of the information system being developed, the design of the software and the rationale for selecting the software tools/languages and database management software for the project.

- **C3**
Each student will understand the impact of issues like privacy on individual databases and database system design.

Each student will understand the ethics behind data and software use.

472 **A2, B3**

474 **A2, A3, B1**
Students should know the basic principles of artificial neural networks and their applications in pattern recognition.

477 **A2, A3, B1**

Assessment Measures

A standard form is used for assessing program outcomes from seniors and alumni. Once every semester a student forum is conducted for informal assessment of the program and courses.

Assessment Data

Senior surveys are conducted every semester and the results are aggregated. Alumni surveys are done during career days and also through mailing lists from time to time. Student forums are conducted once a semester to receive informal feedback about various aspects of the curriculum. Data from these assessments are distributed to the faculty and the undergraduate committee.