Summer 2020

CS 241-450: Foundations of Computer Science I

Adrian Ionescu

CS 241 COURSE SYLLABUS - SUMMER 2020

NJIT ACADEMIC INTEGRITY CODE: All Students should be aware that the Department of Mathematical Sciences takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

CS 241: Foundations of Computer Science I (Discrete Mathematics for CS)

Number of Credits: 3

Course Description: This course provides the mathematical and analytical foundations of computer science and its applications to various areas in CS. The course covers the material traditionally known as "discrete mathematics", with special emphasis on CS applications and an analysis of algorithms. The course topics include sets and logic, proof techniques, proof by induction, functions and relations, analysis of algorithms, recursion, recurrence equations, divide-and- conquer design technique, counting methods (permutations and combinations), basic discrete probability, and if time permits, introduction to number theory, and a brief introduction to graphs and trees. Prerequisites: *Prerequisites*: CS 114: Intro to Computer Science; Math 112: Calculus II.

Course Objectives (what you are expected to know to complete this course)

1. Know basic mathematical tools and terminologies used in computer science
2. Know set algebra, propositional logic, reasoning, and basic proof techniques
3. know induction, recursion, recurrence equations, and how they are interrelated
4. Know the mathematical tools used to analyze efficiency of algorithms
5. Implement simple programs and run experiments to measure their time complexity
6. Learn permutations/combinations, basic discrete probability and applications
7. Introduction to graph theory

Textbook: Textbook: R. Johnsonbaugh, "*Discrete Mathematics*," Pearson, 8th Ed

Instructor:

CS 241-450	Adrian Ionescu

Grading Policy: The final grade in this course will be determined as follows:

▪ **Quizzes, Homework, Projects:**	**30%**
▪ **Midterm Exam:**	**30%**
▪ **Final Exam:**	**40%**

Note: You need a LockDown Browser and a Webcam for Online Exams & Quizzes (Canvas).

Drop Date: Please note that the University Drop Date **June 13, 2020** deadline will be strictly enforced.

Homework Policy: Homework problems will be assigned in class, aside from what is listed below in the Course Outline.

Attendance: Attendance at all classes will be recorded and is **mandatory**. We will use **Webex** for lectures. Please make sure you read and fully understand the Department's Attendance Policy. This policy will be **strictly** enforced. Absences from class will inhibit your ability to fully participate in class discussions and problem solving sessions and, therefore, affect your grade. Each student should have contact information of several fellow students to get homework assignments and class notes when absent. You are responsible for everything that happens in class whether you are present or not online.

Makeup Exam Policy: There will be **NO MAKE-UP EXAMS** during the semester. In the event the Final Exam is not taken, under rare circumstances where the student has a legitimate reason for missing the final exam, a makeup exam will be administered by the department. In any case the student must notify the **Dean of Students' Office and the Instructor** that the exam will be missed, and present written verifiable proof of the reason for missing the exam, e.g., a doctor's note, police report, court notice, etc., clearly stating the date AND time of the mitigating problem. An email from the Dean of Students' Office confirming the legitimacy of the excuse is required.

Further Assistance: For further questions, students should contact their Instructor.

CALENDAR

Date	Day	Event
May 18, 2020	M	First Day of Classes
June 13, 2020	Sa	Last Day to Withdraw
July 4, 2020	Sa	Independence Day -No Classes
July 14, 2020	Tue	Last Day of Classes

COURSE OUTLINE

WEEK	Johnsonbaugh	Topics
1	Chapter 1	**Sets and Logic**: Sets, Propositional Logic, Quantifiers **HW**: 1.1 (1-100 blues), 1.2 (23-30 all), 1.3 (63-72 all), 1.5 (53-59 all), 1.6 (48-66 all)
2	Chapter 2 Chapter 5	**Proof Techniques:** Direct Proof, Counterexample, Contrapositive, Proof by Contradiction, Enumeration Proof**,** Proof by Induction; Strong Induction **Introduction to Number Theory** (as time permits) **HW**: 2.1 (1-55 blues), 2.2 (1-37 blues), 2.4 (1-28 blues), 2.5 (1-10 blues)
3	Chapter 3	**Functions and Relations:** Functions Relations Properties: Reflexive, Symmetric, Transitive**;** Partial Order, Total Order, Equivalence Relations**,** Matrices of Relations Application: Relational Databases **HW**: 3.1 (1-55 blues – *as time permits*), 3.2 (1-100 blues – as time permits), 3.3 (1-44 blues), 3.4 (1-37 blues), 3.5 (1-10 blues – *as time permits*)
4	Midterm	**REVIEW and MIDTERM**
5	Chapter 4 Chapter 7	**Algorithms:** Analysis of Algorithms, Recursive Algorithms, Use of Recurrences to Analyze Algorithms **HW**: 4.3 (1-99 blues – *as time permits*), 4.4 (1-30 blues – *as time permits*) **Recurrence Equations:** Divide-and-Conquer Recurrences, Master Theorem**,** Linear Recurrences **HW**: 7.1 (1-58 blues – *as time permits*), 7.2 (1-25 blues)
6	Chapter 6	**Counting Methods:** Permutations and Combinations**,** Principle of Inclusion/Exclusion, Pigeonhole Principle**,** Introduction to Basic Probability **HW**: 6.1 (1-92 blues), 6.2 (1-68 blues), 6.3 (1-7 all), 6.5 (1-44 blues), 6.6 (1-63 blues), 6.7 (1-33 blues) , 6.8 (1-33 blues)

7	Chapters 8-9	**Introduction to Trees and Graphs** : Graphs, Euler and Hamiltonian Cycles, Dijkstra Algorithm, Isomorphisms of Graphs and Trees **HW**: 8.1 (1-27 blues), 8.2 (1-37 blues), 8.3 (1-15 blues), 8.4 (1-5 all), 8.5 (1-19 blues – *as time permits*), 8.6 (1-13 blues – *as time permits*), 9.8 (1-22 blues – *as time permits*)
8	Final Exam	**REVIEW and FINAL EXAM**

Prepared By: Prof. Adrian Ionescu

Last revised: May 17, 2020