Syllabus for CS 4114
Formal Languages and Automata Theory
Spring, 2001

`http://courses.cs.vt.edu/~cs4114`

Class listserve: `CS4114_11381@listserv.vt.edu`

Instructor: Lenwood Heath

- **Office:** 638 McBryde Hall
- **Office Hours:** Tuesday, Thursday 11:00-12:00; Friday 9:00-10:00
- **EMAIL:** `heath@cs.vt.edu`

Graduate Teaching Assistant: Xinhuo Yang

- **Office Hours Held:** McBryde 133
- **Office Hours:** Consult web page
- **EMAIL:** `xiyang2@vt.edu`

Class Meets: McBryde 216, TTh 9:30–10:45 AM

Exams:

Midterm Exam	Thursday, March 1, 9:30–10:45 AM
Final Exam	Saturday, May 5, 1:05–3:05 PM

Index Number: 11381

Prerequisites:

Math 3134 or 3034

Textbook:

Required:	*Languages and Machines (Second Edition),* Sudkamp—Chapters 1–10 and 16
Optional:	*CS 4114 Lecture Notes,* available from A-1 Copies or the web

On Reserve:

- See class Web site for the current list.

Description

This course presents formal models for the computation of functions and for the recognition and generation of languages. The central goal is to define the four language classes in the Chomsky hierarchy in terms of grammars that generate each class and in terms of automata that recognize each class. Contents of the course are largely mathematical, including mathematical proofs and especially proofs by induction.

Ethics

The atmosphere in this course should promote the free exchange of information and aid. Students are encouraged to seek help from the instructor, the GTA, and fellow students regarding concepts, examples, and problems that are not to be submitted for a grade. Problems from the textbook or from books on reserve are an excellent opportunity for collaborative work; the *assigned* problems are not. **The Honor Code applies to all graded work, in particular to the assigned homework problems**. All work submitted for a grade must be the student's own work.

Announcement

If any student needs special accommodations because of a disability, please contact the instructor during the first week of classes.

Distribution and Access

Course materials are distributed over the web. The URL for the course home page is

`http://courses.cs.vt.edu/~cs4114`

All access to online course materials can be accomplished through first accessing this page and following the available links. All handouts, including assignments and their solutions, will be available here. The lecture notes will also be available on the class web pages. Students should become familiar with the structure of these materials early in the semester.

You are encouraged to send questions to the instructor or the GTA by email. On occasion, announcements will be made on the class listserve `CS4114_1388@listserv.vt.edu`. The listserve is also available for class discussion.

Homework Assignments

There are eight homework assignments, always due at 12:00 noon on a Friday. **NO LATE HOMEWORK ASSIGNMENTS WILL BE ACCEPTED.** For due dates, see the due date handout or the class web pages. All submitted homework solutions must be legible and well-reasoned. Each submitted homework solution must be prepared electronically. Your submission can be a printout delivered to the instructor by the due time or as a Postscript or PDF file attached to an email message sent to both `cs4114@courses.cs.vt.edu` and `xiyang2@vt.edu`. Submission details will be included in each assignment. Until the deadline for submission, you may submit more than one version of your solutions. The last one submitted is the one that will be graded. Your solutions will be graded by Mr. Yang, and your graded work will be returned in class.

Each assignment is distributed as a LaTeX file that may be modified to produce your solution document. It is also distributed as a Postscript file and as a PDF file. Each assignment consists of some number (typically two or three) of problems. Solutions to all problems must be submitted. Solutions to homework problems will be distributed and posted to the class Web site after the deadline for submission has passed.

Readings

For all lectures or sequence of lectures, there is a reading assignment to be completed by class time. These assignments are given as part of the Course Outline.

Grading Policy

Grading for the course is on a 1000-point scale, with the points distributed as follows:

Homework assignments (8 worth 75 points each)	600
Midterm Exam (covers Chapters 1–5)	150
Final Exam (comprehensive)	250

NO UNEXCUSED LATE HOMEWORK OR MISSED EXAMS WILL BE ACCEPTED. A student who has a legitimate medical or other emergency must provide written documentation of the excuse (e.g., a doctor's note) to the instructor as soon as possible. Unavoidable absences, such as job interviews, should be discussed with the instructor well in advance.

If you have questions about the way an assignment was graded, you should ask the GTA first and then consult the instructor.

All exams are open-book, open-note. The final exam covers all the material in the course.

Course Outline

The Course Outline on the next page defines in greater detail what material is covered in the course and approximately when it is covered.

Course Outline

Topic	Reading	Week
Mathematical Concepts (Review) Countable and Uncountable Sets Recursive Definitions Proof by Induction	(Ch. 1)	1
Languages Strings and Languages Regular Sets	(Ch. 2)	2
Context-Free Grammars Language Generation Examples Regular Grammars	(Ch. 3)	3–4
Parsing Top-down Bottom-up	(Ch. 4)	5
Normal Forms for Grammars Chomsky Normal Form	(Ch. 5)	6
Finite Automata Deterministic Finite Automata Nondeterministic Finite Automata State Minimization Regular Sets	(Ch. 6)	7–8
Regular Languages Regular Grammars Pumping Lemma for Regular Languages Closure Properties for Regular Languages	(Ch. 7)	9
Pushdown Automata Accepting Context-Free Languages Pumping Lemma for Context-Free Languages Closure Properties for Context-Free Languages	(Ch. 8)	10
Deterministic Parsing (LL(k) Grammars) Top-down	(Ch. 16)	11
Turing Machines Standard Model Accepting Languages Mechanical Variations Nondeterministic Turing Machines	(Ch. 9)	12–13
Chomsky Hierarchy Unrestricted Grammars Context-Sensitive Grammars Linear-Bounded Automata	(Ch. 10)	14

End of Syllabus