# Formal Languages and Functional Programming
## CSCI 301 — Fall, 2013 — Syllabus

**Catalog copy:** Introduction to discrete structures important to computer science, including sets, trees, functions, and relations. Proof techniques. Introduction to the formal language classes and their machines, including regular languages and finite automata, context free languages and pushdown automata. Turing machines and computability will be introduced. Programming using a functional language is required in the implementation of concepts. Includes lab.

**Website:** We will be using WWU's *Canvas* system, available at `https://wwu.instructure.com/`, or from the Canvas button at the top of your MyWestern page.

**Instructor:** Geoffrey Matthews
`geoffrey dot matthews at wwu dot edu`

**TA:** David Palzer
`davidpalzer at gmail dot com`

**Goals:** This class is an introduction to computer science *theory*. This is exactly parallel to the distinction between theoretical physics and applied physics. We will use simplified, abstract, ideal mathematical models of computers, so that we can study the theoretical limits of what can be accomplished by what kinds of machines, how powerful machines can be ultimately, *etc.*

**Text:** We will use several online texts, as well as instructor handouts. URLs for the online texts are in the schedule below.

**Lecture:** MTRF 1:00; ES 100

**Office hours:** MTRF 2:00; CF 469

**Labs:**

| | | | |
|---|---|---|---|
| T | 2:00-3:50 | CF 414 | David Palzer |
| W | 10:00-11:50 | CF 414 | David Palzer |

There will be five short lab assignments to get familiar with scheme. Due dates will be given with each assignment.

**Projects:** There will be three programming projects in scheme, of a more open-ended variety. Your TA will be available to help your work on these during lab time. Due dates will be given with each assignment, but they should take about two weeks each.

**Homework:** There will be paper-and-pencil math homework assigned throughout the quarter. Due dates will be given with each assignment.

**Exams:** A midterm and a final, according to the schedule below. The final will be cumulative.

**Assessment:** Your grade will be based on the labs, projects, homework, and the two exams Percentages are as shown below.

| Labs | Projects | Homework | Midterm | Final |
|---|---|---|---|---|
| 20 | 20 | 20 | 15 | 25 |

Grades will be assigned based on the following percentages. At the discretion of the instructor, scores may be scaled to the highest grade (curved). Awarding $\pm$ is also at the discretion of the instructor.

| % | 90-100 | 80-89 | 70-79 | 60-69 | 0-60 |
|---|---|---|---|---|---|
| Grade | A | B | C | D | F |

**Late work:** Submissions are due before midnight of the due date. Anything turned in later than that time will be accepted with a 20% penalty per day (or fraction of a day). Anything more than 5 days late will not be accepted. It is the student's responsibility to make sure all assignments are correctly submitted.

**Attendance policy:** Attendance is required. Studies show that regular attendance is highly correlated with performance. Your instructor may take attendance from time to time, to get familiar with your names, and also to have a rough guide to who is showing up.

The student is responsible for all material covered in the lectures, even if it is not presented in the books, the notes, or anywhere else. If you miss a lecture, make sure you get notes from another student. The instructor will *not* give you a private summary of the lecture during office hours, you are expected to attend the lecture itself.

If you have a well documented emergency (illness, military service, school sponsored athletic events, *etc.*) notify your instructor as soon as possible and present documentation (a note from your mother is not sufficient). The instructor may, at his discretion, extend the due date for the assignment, schedule a make-up exam, or simply adjust your remaining scores to determine your grade.

**Mentors** The student ACM chapter provides mentors: `http://acm.wwu.edu`. If you are serious about becoming a computer scientist, you should consider joining ACM.

**Academic dishonesty:** Please read Appendix D of WWU's Catalog on Academic Dishonesty. It is available online at `http://catalog.wwu.edu`.

Unless specified otherwise (for example, in the paired programming labs), all work for this course is meant to be done **individually.** The work that

you turn in for a grade must be completely your own, or you will be guilty of academic dishonesty and could receive an F for the course.

However, it can be a valiable learning experience to discuss work with your fellow students, and this is encouraged. However, after working with a colleague, **you may not keep any paper or electronic copies of anything you produced together!** You may only keep your memories. In particular, this means that **you may not ask for or give help while sitting in front of a computer where the assignment is open!** Also, **you may not use anything a colleague has emailed to you!** Delete the email and do not save a copy.

To help understand what I mean, remember THE SIMPSON'S RULE: You may discuss, sketch, write things down, use your computers, whatever, but after you are done working with your fellow students all files must be deleted, and all papers you created must be destroyed. For good measure, you should then watch a rerun of *the Simpson's*, after which you can go back to your assignment (alone) and use the knowledge you have now gained.

It is very easy for experienced software developers like your instructor and your TA to detect copied assignments. Please do not put us in a situation where we have to fail you for plagiarism.

## Schedule

|  | Su | Mo | Tu | We | Th | Fr | Sa |  |
|---|---|---|---|---|---|---|---|---|
| Sep | 22 | 23 | 24 | 25 | 26 | 27 | 28 | Scheme, *Compbook*, Chap 3,4,5 |
|  |  |  |  |  |  |  |  | *TYS*, Chap 1,2,3,4,5,6,7 |
|  |  |  |  |  |  |  |  | *TSPL*, Chap 1,2,3,4,5,6,7 |
| Oct | 29 | 30 | 1 | 2 | 3 | 4 | 5 | Sets, Logic, Counting, *BoP*, Chap 1,2,3 |
|  | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Proof, *BoP*, Chap 4,5,6,7,8,9 |
|  | 13 | 14 | 15 | 16 | 17 | 18 | 19 | Induction, Relations, Functions, Cardinality, *BoP*, Chap 10,11,12,13 |
|  | 20 | 21 | 22 | 23 | 24 | 25 | 26 | Regular Languages and FSAs, *Langmach*, Chap 2,4,5,6,7 |
|  | 27 | 28 | 29 | 30 | 31 | 1 | 2 |  |
|  | 3 | 4 | 5 | 6 | 7 | 8 | 9 | **Midterm, Tue, Nov 5** |
|  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | Context Free Languages and PDAs (instructor notes) |
|  | 17 | 18 | 19 | 20 | 21 | 22 | 23 |  |
|  | 24 | 25 | 26 | 27 | 28 | 29 | 30 | Turing Machines, *Langmach*, Chap 8,9,10 |
| Dec | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Computability, *Compbook*, Chap 8,9,10 |
|  | 8 | 9 | 10 | 11 | 12 | 13 | 14 | **Final Exam, Tue, Dec 10, 1:00** |

| Book | URL |
|---|---|
| *Compbook* | http://www.computingbook.org/ |
| *TYS* | http://www.ccs.neu.edu/home/dorai/t-y-scheme/t-y-scheme.html |
| *TSPL* | http://www.scheme.com/tspl4/ |
| *BoP* | http://www.people.vcu.edu/~rhammack/BookOfProof/ |
| *Langmach* | http://maths.mq.edu.au/~chris/notes/second_langmach.html |