College of Arts & Science: CPS 440 - Theoretical Foundations of Computer Science

Instructor	**Dr. Ethan McGee**
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Office Hours	MWF 12:00 - 1:00
	TTh 2:00 - 3:00
	Others by appt / elec
Text(s)	*Introducing the Theory of Computation* (Goddard) or *Introduction to the Theory of Computation* (Sipser)
Meets	TTh 12:30 - 1:50 in AL 315
Credits	3
Prerequisites	CpS 210, Ma 150

Course Description

A study in finite state machines, Turing machines, computability and formal languages.

Course Context

This course serves as a major intersection between Computer Science and Mathematics, therefore, it fulfills the following objectives from each department.

- Computer Science
  - CS1. Design and implement efficient solutions to problems in various domains.
  - CS2. Demonstrate understanding of fundamental concepts in computer science.
  - CS3. Communicate technical information effectively, including software design and requirements documents.
  - CS4. Evaluate and assess software technologies for use in solving specific problems.
  - CS5. Apply Biblical principles of ethics to computing.
- Math
  - DM1. Mature the student in the theory and applications of mathematics.
  - DM2. Provide the student the required mathematical background to function and contribute effectively in today’s technological society
  - DM3. Provide the student a platform for continued learning and development of his God-given abilities.
  - DM4. Instill in the student a desire to use his abilities in service to Christ.
  - DM5. Provide an appropriate liberal arts complement to a wide variety of majors

Course Goals / Objectives

Specifically, the goals of this course are to:

- introduce the student to automata theory
    - study techniques and proofs with finite automata
    - study techniques and proofs with push-down automata
    - study techniques and proofs with turing machines
- use the concepts of automata theory to introduce complexity theory
    - determine a problem's complexity class
    - prove that certain complexity classes are subsets of larger complexity classes
    - prove that certain complexity classes are actually equal
- use the concepts of automata theory to introduce computability theory
    - determine a problem's computability
    - show fundamental limitations of computation

Assignments

Tests: taken in class; closed-book/notes unless otherwise announced.

Homeworks: almost weekly assignments given to re-inforce concepts covered in class.

Presentation: students will select and present a NP-Complete problem of their choice. The presentation will introduce the problem as well as detail the proof of the problem's NP-Completeness. Time limit for the presentation is 20 minutes.

Grading

Assignment Type	# of Assignments	Points Worth	Total Points
Tests	4	125	500
Homework	11	25	250
Presentation	1	50	50
Total			800

Grade	Minimum	Maximum
A	89.5	100
B	79.5	89.5
C	69.5	79.5
D	59.5	69.5
F	0	59.5

Deadlines / Late Work

The instructor reserves the right to change assignment due dates as deemed necessary. Assignments are due, electronically, by 11:59 pm of the date posted in the course schedule unless otherwise noted. Assignments, unless otherwise noted, may be turned in up to 1 week after the deadline for a 25% penalty. After 1 week, the student may still submit the assignment for feedback, however, no credit will be given.

Each student is given 1 free late waiver that allows them to turn in one assignment, at their

discretion, up to 1 week after the deadline with no penalty. In order to use the free late, the student must 1) notify the professor before the deadline that they intend to use the free late, 2) describe the progress that they have made towards completion of the assignment and 3) provide an approximate date of delivery. Due to grading constraints during finals week, the professor reserves the right to shorten the free late period for end of semester projects.

Getting Help

Students struggling with an assignment or concepts in the class are encouraged to ask the instructor for assistance either 1) in class, 2) before / after class, 3) during office hours, 4) via email or 5) via slack.

In order to maximize your opportunity to receive help and receive the best possible grade on an assignment / in the course:

1. Start assignments early. This will give you more opportunities to realize you don't fully understand a concept and ask for assistance.
2. Don't wait until the night before an assignment is due to ask questions. The night an assignment is due typically sees a mad rush of questions, and I answer questions in the order that I receive them. There is no guarantee that I will be able to answer your question before the submission deadline.
3. Request feedback. I cannot tell you what grade I would give to your particular solution for an assignment, but I can offer comments for how your solution can be improved.

Handbook Policies

Compliance with student handbook policies is expected during class.

Attendance

The University’s mission includes instilling responsibility, dependability and punctuality in students. Training students in these virtues is accomplished in part through holding students accountable for their class attendance. The Class Attendance Policy makes clear to students expectations in regard to class attendance and the consequences of failure to fulfill these academic responsibilities. This policy also gives direction to the administration and faculty in formulating and implementing a reasonable structure for such accountability.

The University recognizes that there are valuable learning experiences outside of the classroom that may require a student to miss regularly scheduled classes. Therefore this policy makes provision for service absences.

Student Responsibilities

Undergraduate students are expected to attend and arrive on time for all scheduled class sessions for each course in which they are enrolled, including final exams. Students are to use effective time management in order to meet their class attendance responsibilities.

Personal Absences

Based on the number of times that a course meets each week during a semester, students are permitted a defined number of personal absences. The chart below defines the number of permitted personal absences.

Students apply personal absences for funerals, for sickness, for doctor's or dentist's appointments, for visits and interviews at graduate schools or for interviews for future employment. Personal absences are not "skips." Personal absences are not provided so that students can prepare for other classes or extend official university breaks or simply because they do not feel well. Students should use personal absences only for genuine emergencies or contagious or debilitating illness. In order to conserve personal absences, students should work with doctor's or dentist's offices to intentionally schedule appointments during times when they do not have classes or chapel.

Class Meetings per Week	**1**	**2**	**3**	**4**	**5**	**Block**
Personal Absences Allowed	1	2	3	4	5	0

Students who are withdrawn from courses due to excess class absences may lose student financial aid; also, in such circumstances, the visa status of international students may be jeopardized.

Service Absences

Based on the number of times that a course meets each week during a semester, students are also permitted a defined number of service absences. Students may use these absences to attend approved academic functions or conferences, approved Christian service projects, required military duty or as part of an intercollegiate athletic team. However, students who exceed the personal absence limit due to a chronic illness are not eligible to participate in events that require services absences. Also, students who are on any type of academic restriction (including probation) or who have a current grade report with a cumulative GPA below 2.0 are not eligible to participate in events that require service absences. The chart below defines the number of permitted service absences.

Class Meetings per Week	**1**	**2**	**3**	**4**	**5**	**Block**
Service Absences Allowed	1	3	4	5	7	0

Students should understand that they may not have enough service absences to participate in all the events that are offered in the courses and activities in which they are participating in a particular semester. Such a circumstance offers students the opportunity to learn that life at times will force them to make a choice between more than one desirable option. In such a situation, students are not permitted to exceed the number of permitted service absences for the course, and so they must choose which service events they wish to participate in.

Students who participate in an event requiring a service absence are required to contact their instructors at least one week in advance of the absence to make up work that will be missed. Such students will be allowed to take any quiz or test either in advance of the absence or while traveling (with proper supervision by the faculty sponsor/coach). Such students are responsible to schedule presentations or speeches on days they know they will not be traveling. Whether to allow students

participating in these events to submit work after the due date without penalty is left to the instructor's discretion.

Partial Attendance

Students who arrive up to 15 minutes after the start of class or who leave class up to 15 minutes early will receive a mark for partial attendance. Three partial attendance marks will count as a personal absence. Students who miss more than 15 minutes of a class period will be counted as absent.

Tracking Absences

Students can view absences and the number of partial attendance marks that they have for a course in StudentCentral. StudentCentral also automatically sends emails to students to inform them when faculty have marked them absent or late for a class and to warn them when they have exhausted their personal absences, service absences or both. It is the responsibility of all students to monitor the record of their class attendance available in StudentCentral and to read the automated emails that inform them when instructors have marked them absent or late.

Chronic Illness

Students who have a chronic illness (e.g., diabetes, asthma, migraines, etc.) and are absent from classes because of prolonged or recurring symptoms:

- are to secure a doctor's note stating that they have a chronic illness;
- are to present the note to The Hub in advance or within two business days of returning to classes after an illness-related absence;
- are to inform instructors in their courses that they have a chronic condition.

For future absences because of the same chronic illness, the student is to email The Hub (hub@bju.edu) the following information within 24 hours of a missed class:

- Name and ID #
- A statement indicating that the reason for the absence is a chronic condition with a doctor's note already on file
- Date and class(es) missed

Students with a chronic illness are to keep their class absences to a minimum. Students with chronic illnesses may use the total of both personal absences and service absences. However, students who exceed the personal absence limit due to a chronic illness are not eligible for participation in events that require services absences. Students who exceed the total of both personal absences and service absences will be withdrawn from the course(s) and/or the University.

Doctor's notes for chronic illness are valid for the current academic year. For continuing illness, a new note is required each academic year.

Accomodations

Students needing accomodations due to a learning disability (visual, auditory, etc.) should provide an accomodation form obtained from the Academic Resource Center as soon as possible. Accomodations cannot be given without a form provided by the Academic Resource Center.

Academic Honesty and Integrity Policy

Cheating on assignments and tests is forbidden. All work is to be done individually unless group work is explicitly permitted. No collaboration is allowed on tests. For regular individual assignments, we expect that the submitted work represents the student's own intellectual effort, defined as follows:

1. The program was written primarily by the student. This means that most of the code (aside from starting code provided by the instructor) must have been crafted, not copied, by the student.

2. External resources used, whether electronic or from another human, must be documented as follows:

    1. Code snippets copied from online resources must be documented by a comment just above the copied snippet giving the URL of the page containing the source.

    2. Explanatory help or advice regarding the design or implementation of the solution received from people other than the instructor must be documented in a report accompanying the assignment submission. This report must detail:

        1. Source of information (e.g., name/email of the person who helped)
        2. Relevance (i.e., how this resource helped and/or what it provided)

    3. Note that students must not consult a solution to the assignment as a resource in crafting their own solution, nor share their own solution with another student. Doing so constitutes cheating.

3. The student must be able to explain, on demand, the entirety of the program on both the syntactic and semantic level.

Not all kinds of programming assignments require the same demonstration of personal intellectual effort. In the absence of any specific instructions, students should assume that at a minimum:

- For individual lab assignments, requirements 1 and 3 apply.
- For individual programming assignments, all three requirements apply.
- For group programming projects, only requirement 3 applies.

Failure to comply with any relevant integrity requirement constitutes cheating. Such incidents will be reported to the academic integrity committee. To avoid trouble:

- Do not look at another student's program code when seeking assistance. On the other hand, if another student is seeking help from you, never use your own program code as an example. The only acceptable reason another student may look at your code is to help you find a problem in your program.
- Do not write program code while another student (or lab assistant) is sitting with you. You may work out designs in pseudocode on paper with another student, but you must write program code by yourself.
- When seeking assistance from another person on a program assignment, always get his/her name so you can fulfill the documentation requirements.

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