Class Syllabus

CSE 1400 Applied Discrete Mathematics
& MTH 2051 Discrete Mathematics

Instructor: William Shoaff
Spring 2018 (January 19, 2018)
Course Description

CSE 1400 Applied Discrete Mathematics cross-listed with MTH 2051 Discrete Mathematics (3 credits). Topics include positional and modular number systems, relations and their graphs, discrete functions, set theory, propositional and predicate logic, sequences, summations, mathematical induction and proofs by contradiction. (Requirement: Passing score on the Calculus Readiness Test, or prerequisite course.) Prerequisites: MTH 1000 Precalculus.

Prerequisites

Students must have mastered certain mathematical knowledge to be successful. In particular, students must be able to perform arithmetic on natural numbers, integers, and rational numbers, and they must be able to use concepts from “College Algebra” and “Precalculus.” In brief, students should have satisfied the requirements necessary to be prepared to study calculus. Students should be aware of the strong correlation between class attendance and grades. In brief, students must be engaged in learning and fully participate in all activities. If you have already mastered all of the material in this course, speak with your professor about an equivalency exam.

Students, Professor & Assistants

Students

Get to know your fellow classmates. Help each other.

The Professor

William David Shoaff
wds@cs.fit.edu
(321) 674-8066
Room 324, Harris Center for Science and Engineering
MWF 9:30 – 10:45 or by appointment, walk-ins welcome

Assistants

Zubin Kadva
zkadva2016@my.fit.edu

Class Hours: Monday, Wednesday, and Friday from 2:00 to 2:50 in Evans Library, 133
Office Hours: Monday, Wednesday, and Friday at 9:30 and 10:45.

Modern learning theory (Fuson et al., 2005) suggests that students learn when they have (1) an ability to link conceptual understanding with procedural fluency; (2) meta-cognition (learning they how learn and think; and (3) problem solving abilities.
Calendar

The projected class calendar is here. A partial calendar is posted on the course management system.

Material

There is material on the course management system. The main use of the CMS is for communicating, posting grades, collecting basic items, and linking back to the class URL. The class URL is

http://cs.fit.edu/~wds/classes/adm

There you will find, perhaps too much, material such as:

1. This syllabus
2. Previous quizzes with keys
3. A textbook
4. Summary slides
5. Recorded lectures
6. A great cheat sheet

There are other excellent sources that you can use to learn the topics of discrete mathematics, for example, (Rosen, 2011), (Epp, 2010), (Stanoyevitch, 2011), (Bender and Williamson, 2005), and (Belcastro, Sarah-Marie, 2012).

Policy

Attendance

The class meets on Monday, Wednesday and Friday at 2:00 for a 50 minute session. The location is Evans Library, 133. Attendance is required. If, for some reason ¹, you cannot attend class inform your professor as soon as possible. Written documentation is necessary for an absence to be excused.

A recitation session, lead by Zubin Kadva, is scheduled on Monday 11:00 – 1:00 in Olin Engineering 137 & Thursday 4:00 – 6:00 in Skula 104.

Rules for quizzes and exams

¹ Religious holiday, illness or accident, family emergency, …
1. No notes, books, conversations, peeking at a neighbor’s answers, note-passing, sign language, mechanical/electrical devices: abacus, camera, telephone, calculator, etc.

2. First violators of rule 1 will receive a 0 for the test. Second violators of rule 1 will receive an F for the course.

Rules for homework

1. You are encouraged to work with other students in the class or with others from whom you can learn.

2. Do not turn in homework when you do not understand the answers. Ask for guidance instead.

Academic integrity

The department enforces an honor code. This honor code establishes a recommended penalty and reporting structure for academic dishonesty.

<table>
<thead>
<tr>
<th>Offense</th>
<th>Recommended Penalty</th>
<th>Report to</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>Zero on work</td>
<td>Dean of Students</td>
</tr>
<tr>
<td>Second</td>
<td>F in course</td>
<td>Dean of Students</td>
</tr>
<tr>
<td>Third</td>
<td>Expulsion from Program</td>
<td>UDC</td>
</tr>
</tbody>
</table>

Florida Tech provides guidelines to help students understand plagiarism, its consequences, and how to recognize and avoid academic dishonesty. Lipson describes three principles for academic integrity (Lipson, 2004).

1. “When you said you did it, you actually did.”

2. “When you use someone else’s work you cite it. When you use their word, you quote it openly and accurately.”

3. “When you present research materials, you present them fairly and truthfully. That’s true whether the research involves data, documents, or the writing of other scholars.”

Issues and Concerns

1. If you have a disability, inform your teacher. Accommodations can be provided.

2. If you have an academic problem, your teacher can link you to support services.

3. If you have a personal issue, without revealing private information, your teacher can link you to support services.

4. No forms of discrimination or harassment will be tolerated.

The Patsy Mink Equal Opportunity in Education Act, aka Title IX:

What is Title IX?

Title IX of the Educational Amendments Act of 1972 is the federal law prohibiting discrimination based on sex under any education program and/or activity operated by an institution receiving and/or benefiting from federal financial assistance.

Behaviors that can be considered "sexual discrimination" include sexual assault, sexual harassment, stalking, relationship abuse (dating violence and domestic violence), sexual misconduct, and gender discrimination. You are encouraged to report these behaviors.

Reporting

Florida Tech can better support students in trouble if we know about what is happening. Reporting also helps us to identify patterns that might arise – for example, if more than one complainant reports having been assaulted or harassed by the same individual.

Florida Tech is committed to providing a safe and positive learning experience. To report a violation of sexual misconduct or gender discrimination, please contact Security at 321-674-8111. * Please note that as your professor, I am required to report any incidences to Security or to the Title IX Coordinator (321-674-8700). For confidential reporting, please contact CAPS at 321-674-8050.

Don’t fail in silence!

Richard Ford’s advice to new students, The Florida Tech Crimson, Fall 2011, Issue 2
Where to Get Help

1. Your professors (For this class: MWF 9:30 – 10:45 or by appointment)
2. Recitation sessions lead by Zubin Kadva on Monday 11:00 – 1:00 in Olin Engineering 137 & Thursday 4:00 – 6:00 in Skula 104
3. Your academic advisor
4. Your first-year advisor
5. The Computer Sciences Help Desk
6. The Academic Support Center
7. Counseling and Psychological Services

Topics

The course prepares students to solve problems in computing with applications in business, engineering, mathematics, the social and physical sciences and many other fields. Students study discrete, finite and countably infinite structures: logic and proofs, sets, naming systems, in particular, number systems, relations, functions, sequences, graphs, and combinatorics. These topics are commonly used when reasoning about problems and developing correct algorithmic solutions for them.

Outcomes

By the end of the course, each student will be able to:

1. Comprehend and use propositional and predicate logic. (1: Fundamental knowledge), 2: Scientific, computing, and engineering problem solving)
2. Understand naive set theory, set operations, cardinality and power sets, and the use sets to describe collections of objects. (1: Fundamental knowledge), 2: Scientific, computing, and engineering problem solving)
3. Understand the value of positional numbers written in various bases (e.g., 2, 8, 10, 16); Interpret the meaning of numeral strings in various contexts: Unsigned, signed (sign/magnitude, two’s complement, biased), fixed-point, floating-point. (1: Fundamental knowledge)

Example of course skills:
1. The decimal number 15 can be written as
   \[
   (15)_{10} = (1111)_{2} = (01111)_{2c} = (F)_{16}
   \]
2. \( x \in \emptyset \implies x \in X \).
3. For all natural numbers \( n \)
   \[
   \sum_{0 \leq k < n} 2^k = 2^n - 1
   \]
4. For all sets \( X \) and \( Y \),
   \[
   \neg(\neg X \cup Y) = X \cap \neg Y.
   \]
5. If \( p = \text{False} \), \( q = \text{False} \), and \( r = \text{True} \), then
   \[
   (p \rightarrow q) \land (\neg p \rightarrow r) = \text{True}.
   \]
6. You can fool some of the people all of the time, and all of the people some of the time, but you cannot fool all of the people all of the time.

\[
\begin{align*}
(\exists p)(\forall t)(\text{canfool}(p, t)) \\
\land (\forall p)(\exists t)(\text{canfool}(p, t)) \\
\land (\exists p)(\exists t)(\neg\text{canfool}(p, t)).
\end{align*}
\]
7. Partial orders and equivalences:
   \[
   \subseteq \text{ is a partial order on } 2^X. \\
   \equiv_{m} \text{ is an equivalence on } \mathbb{Z}.
   \]
8. Using an \( O(n \lg n) \) sorting algorithm, a million things can be ordered in about 20 million steps.
9. There are \( \binom{n}{k} \) \( k \)-elements subsets of an \( n \)-element set.
10. Basic number theoretic concepts
    \[
    \begin{align*}
    &P = \{2, 3, 5, 7, 11, \ldots\} \\
    &\gcd(51, 24) = 3 \\
    &3x = 4 \mod 5 \implies x = 3
    \end{align*}
    \]
4. Perform arithmetic with modular numbers, solve linear congruence equations, and know some applications where modular number occur. (1: Fundamental knowledge)

5. Use concepts of relations; represent relations as adjacency matrices, graphs or sets of ordered pairs; know relational properties that define equivalences and orders. (1: Fundamental knowledge), (2: Scientific, computing, and engineering problem solving)

6. Know basic functions (polynomials, logarithms and exponentials, integer functions, permutations) and some of their uses. (1: Fundamental knowledge)

7. Know several important sequences (e.g., Fibonacci, Mersenne, triangular, binomial coefficients) their uses in counting and other applications, use functions, recurrence relations and algorithms to compute terms in these sequences. (1: Fundamental knowledge)

8. Know partial sums of several important sequences. (1: Fundamental knowledge)

9. Establish the truth of propositions using forms of mathematical proof: Induction, direct, indirect, contradiction. (1: Fundamental knowledge)


Grades

Your final grade will be based on your performance on quizzes, examinations, and discussions of your homework during student-teacher meetings.

<table>
<thead>
<tr>
<th>Grades and their relation to performance</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>Excellent</td>
<td>Good</td>
<td>Average</td>
<td>Poor</td>
<td>Failure</td>
</tr>
</tbody>
</table>

Student performance is measured in the following ways.

1. Four quizzes (60% of grade)
2. A comprehensive midterm examination (20% of grade)
3. A comprehensive final examination (20% of grade)

The emphasis is on algorithmic problem-solving. Algorithmic efficiency, elegance, and generality are quality characteristics.

See the course management system for your current grades. The percentage of letter grades, averaged over the last 10 offerings of the class, are

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>29%</td>
<td>27%</td>
<td>20%</td>
<td>14%</td>
<td>11%</td>
</tr>
</tbody>
</table>
Your score $S$ will be a rational number between 0 and 100 computed by the formula

$$S = \frac{15}{100} \left( \sum_{k=0}^{3} q_k \right) + \frac{20}{100} \text{(midterm+final)}$$

where $0 \leq q_k \leq 100$, $k = 0, 1, 2, 3$ are your quiz scores. Extra credit will not be given. Final letter grades will be assigned based on the range in which your score $S$ falls:

$$(90 \leq S \leq 100) \Rightarrow A, \quad (80 \leq S \leq 89) \Rightarrow B, \quad (70 \leq S \leq 79) \Rightarrow C, \quad (60 \leq S \leq 69) \Rightarrow D, \quad (0 \leq S \leq 59) \Rightarrow F$$

The last day to withdraw for the class with a final grade of $W$ is Friday, March 17.

Checking Grades

Check your grades on the course management system. Contact your professor when you find an error in your recorded grades. Be able to document the error.

Measure of Success

The target achievement level is that 70% of students will score at or above average (70%) on the final comprehensive examination. The questions on the final measure attainment of course outcomes.

<table>
<thead>
<tr>
<th>Student’s Score on Final</th>
<th>Below 70%</th>
<th>70% or Above</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2017</td>
<td>40%</td>
<td>60%</td>
</tr>
<tr>
<td>Spring 2017</td>
<td>7%</td>
<td>93%</td>
</tr>
<tr>
<td>Fall 2016</td>
<td>26%</td>
<td>74%</td>
</tr>
<tr>
<td>Fall 2015</td>
<td>15%</td>
<td>85%</td>
</tr>
<tr>
<td>Spring 2015</td>
<td>25%</td>
<td>75%</td>
</tr>
<tr>
<td>Fall 2014</td>
<td>55%</td>
<td>45%</td>
</tr>
<tr>
<td>Spring 2014</td>
<td>32%</td>
<td>68%</td>
</tr>
<tr>
<td>Fall 2013</td>
<td>32%</td>
<td>68%</td>
</tr>
<tr>
<td>Spring 2013</td>
<td>48%</td>
<td>52%</td>
</tr>
<tr>
<td>Fall 2012</td>
<td>38%</td>
<td>62%</td>
</tr>
<tr>
<td>Spring 2012</td>
<td>52%</td>
<td>48%</td>
</tr>
<tr>
<td>Fall 2011</td>
<td>34%</td>
<td>66%</td>
</tr>
<tr>
<td>Spring 2011</td>
<td>43%</td>
<td>57%</td>
</tr>
<tr>
<td>Fall 2010</td>
<td>45%</td>
<td>55%</td>
</tr>
<tr>
<td>Spring 2010</td>
<td>42%</td>
<td>58%</td>
</tr>
</tbody>
</table>
References


