MATH 495R Section 008

Competitive Programming and Machine Learning

TTH, 12:00-12:50PM, TMCB 150

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Office Hours: By Appointment

This syllabus is a guide of the semester and as such is subject to change.

Course Description: Competitive coding is a great way to enhance problem solving skills, improve resumes, and have some nerdy fun. This class is designed to give the students opportunities to learn additional problem solving methods and algorithms. Since this is the second course in the sequence, less focus will be given on standard programming concepts, and more time will be spent on challenging concepts. Similarly, we will give an introduction to competitive machine learning. This class is not designed to be time-consuming, but it will be engaging and challenge students to grow.

Prerequisite: ACME Enrollment.
Note: Even though credit hours are variable, the expected student output is not and will be the same regardless of number of credit hours. In other words, all students will be expect to attend, participate, and program regardless of their credit enrollment.
Credit Hours: 0.5-2 Variable

Optional Text: *Cracking the Coding Interview*, 6$^{\text{th}}$ Edition
Author: Gayle Laakmann McDowell; **ISBN-13:** 978-0984782857

Course Objectives:
At the completion of this course, students will be able to:

1. Work through unknown programming problems making significant progress toward a solution
2. Crush the ACM competition
3. Be comfortable with basic implementation and machine learning terminology
4. Be comfortable solving standard algorithm and data structures problems
5. Gain valuable experience that leads to improved resumes

Grade Distribution:

ACM	50%
The Vat	20%
Machine Learning Projects	20%
Attendance	5%
Quizzes	5%

Course Policies:

- **ACM**
  - The main purpose of this class is to prepare students for the ACM coding competition. It is required that every student attend the full competition on the date it is held. There are very limited exceptions that must be cleared by the instructors in advance. If the exception is approved, students will be required to spend an equivalent amount of time participating in a proctored "mock" ACM competition with the same questions under the direction of the instructors.
- **The Vat**
  - A collection of easy, medium, and hard programming problems will be made available at the beginning of the semester. Students are expected to get **120** points by solving a selection of problems of their choice. Each problem is worth a certain number of points depending on its difficulty.
- **Machine Learning Projects**
  - There will be **4** machine learning projects this semester. These projects will each have a dataset and a goal. They will cover **classification**, **clustering**, **regression**, and **dimensionality reduction**. Each student will apply the techniques for the associated section and submit a **1+** page writeup of their methods and success or failure with necessary supporting material (e.g., graphs, code, etc).
- **Attendance**
  - Attendance is expected and will be taken each class. Students are allowed to miss **4** classes during the semester for any reason without penalty. Any further absences will result in a **1%** drop per day in attendance grade, which can be made up through extra credit work.
- **Quizzes**
  - Before each in class **Hard Problem** taken from The Vat, students will attempt to solve the problem and take a quiz where they report their efforts. These quizzes are intended to improve in class discussion and problem solving since each student will understand the input/output and problem statement. Students will also come with ideas to solve the problem to be discussed in class. Please do not refer to any outside material, or people, when attempting these problems.

- **In Class vs Out of Class work**
  - There will be sufficient time in class to complete a large majority of the assignments. However, it may be required to spend $n \in [0, 20]$ hours outside of class this semester completing The Vat problems or the Machine Learning Projects. However, if the students will make good use of their class time, they will have to spend significantly less time out of class working on required work. Of course, extra practice is always encouraged and will be the true difference between those who do well at the ACM and those who do not.

Honor Code:

In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Violations of this principle may result in a failing grade in the course and additional disciplinary action by the university. Students are also expected to adhere to the Dress and Grooming Standards. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment. It is the university's expectation, and my own expectation in class, that each student will abide by all Honor Code standards. Please call the Honor Code Office at 422-2847 if you have questions about those standards.

Preventing Sexual Misconduct:

As required by Title IX of the Education Amendments of 1972, the university prohibits sex discrimination against any participant in its education programs or activities. Title IX also prohibits sexual harassment?including sexual violence?committed by or against students, university employees, and visitors to campus. As outlined in university policy, sexual harassment, dating violence, domestic violence, sexual assault, and stalking are considered forms of "Sexual Misconduct" prohibited by the university. University policy requires any university employee in a teaching, managerial, or supervisory role to report incidents of Sexual Misconduct that come to their attention through various forms including face-to-face conversation, a written class assignment or paper, class discussion, email, text, or social media post. If you encounter Sexual Misconduct, please contact the Title IX Coordinator at t9coordinator@byu.edu or 801-422-2130 or Ethics Point at https://titleix.byu.edu/report-concern or 1-888-238-1062 (24-hours). Additional information about Title IX and resources available to you can be found at titleix.byu.edu.

Students with Disabilities:

BYU is committed to providing reasonable accommodation to qualified persons with disabilities. If you have any disability that may adversely affect your success in this course, please contact the University Accessibility Center at 422-2767. Services deemed appropriate will be coordinated with the student and instructor by that office.

Tentative Course Outline:

Week	Content
Week 1	• Welcome to class • Blitz
Week 2	• Hard Problem 1 • Hard Problem 2
Week 3	• Machine Learning 1 • Blitz
Week 4	• Hard Problem 3 • Hard Problem 4
Week 5	• Hard Problem 5 • Blitz
Week 6	• Hard Problem 6 • Hard Problem 7
Week 7	• Hard Problem 8 • Final Prep Blitz • ACM
Week 8	• Machine Learning 2 • Machine Learning 2
Week 9	• Blitz • Bonus ML
Week 10	• Machine Learning 3 • Machine Learning 3
Week 11	• Blitz • Bonus ML
Week 12	• Machine Learning 4 • Machine Learning 4
Week 13	• Blitz • Bonus ML
Week 14	• Show and Tell • Show and Tell