Coding Theory

CSE 445/545

February 2, 2022

Please have a face mask on

Masking requirement



<u>UB_requires</u> all students, employees and visitors – regardless of their vaccination status – to wear face coverings while inside campus buildings.

https://www.buffalo.edu/coronavirus/health-and-safety/health-safety-guidelines.html

Make sure to check out the syllabus!

Autolab

Book

Mini Project -



Spring 2022

Syllabus

Piazza

Mondays, Wednesdays and Fridays, 4:00-4:50pm, NSC 🖉 218.

Schedule

Homeworks -

A Under Construction

This page is still under construction. In particular, nothing here is final while this sign still remains here.

Please note

CSE 4/545

It is your responsibility to make sure you read and understand the contents of this syllabus. If you have any questions, please contact the instructor.

Academic Integrity

Signup on piazza

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Instr Algorithms Background We will be studying a few algorithms in this class. Choose an option below that best describes your experience with algo	Mor					×
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Poll up for Yunus' office hours

👖 poll @16 回 🖈 🔓 🗸

stop following 0 views

Yunus's office hours

Please use poll to let us know which of the slots below would work best for you to attend Yunus's office hours (there will be three in total). Few logistical clarifications:

- (v) means that you are voting for virtual only, (i) means you are voting for in-person only and (b) means you are fine with either in-person or virtual. Note that the Wed hours are virtual only.
- Please choose a time slot even if you can say only make half of it.
- It is likely that sometime in March Yunus might move to the west cost on which case we might have to move all his OH 11:30am (eastern) or earlier. For now vote on all possible options (but I wanted to give y'all a headsup on a possibly upcoming change).

I will finalize the slot on Friday night.

Mon, 10-11am (i)

Mon, 10-11am (v)

Mon, 10-11am (b)

Mon, 11am-12pm (i)

Mon, 11am-12pm (v)

Mon, 11am-12pm (b)

Mon, 12-1pm (i)

Mon, 12-1pm (v)

Mon, 12-1pm (b)

🗌 Mon, 1-2pm (i)

Mon, 1-2pm (v)

Make sure you see 4/545 on Autolab

Current

CSE4/545: Coding Theory (s22)

First Submission

COURSE PAGE GRADE SECTION CSE440/441/540: Machine Learning and Society (s22)

COURSE PAGE

Proof readers for today

Julia and Luca

The birth of coding theory

Claude E. Shannon "A Mathematical Theory of Communication" 1948 Gave birth to Information theory

Richard W. Hamming "Error Detecting and Error Correcting Codes" 1950





Structure of the course

Part I: Combinatorics What can and cannot be done with codes

Part II: Algorithms How to use codes efficiently

Part III: Applications Applications in (theoretical) Computer Science

Redundancy vs. Error-correction

Repetition code: Repeat every bit say 100 times Good error correcting properties Too much redundancy Parity code: Add a parity bit Minimum amount of redundancy Bad error correcting properties Two errors go completely undetected Neither of these codes are satisfactory





Two main challenges in coding theory

Problem with parity example

Messages mapped to codewords which do not differ in many places Need to pick a lot of codewords that differ a lot from each other

Efficient decoding

Naive algorithm: check received word with all codewords

The fundamental tradeoff

Correct as many errors as possible with as little redundancy as possible

Can one achieve the "optimal" tradeoff with *efficient* encoding and decoding ?

Rest (of the semester) on the board...

