

EECS 487: Introduction to Natural Language Processing

Instructor: Prof. Lu Wang

Computer Science and Engineering

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Today's Outline

- Welcome!
- Administrivia
- What is natural language processing?
- Text normalization

Course Staffs, Time, and Location

- Instructors

- Prof. Lu Wang
- GSIs: Frederick Zhang, Kaijian (Kai) Zou
- IA: Gordon Lim

- Lecture: Mondays and Wednesdays, 9am to 10:30am, 1013 Dow Building (Lu Wang)
- Lab/Discussion: Fridays, 3:30-5:30pm, 1060 FMCRB (Frederick, Kai, Gordon)

The Goal

- Study fundamental tasks in natural language processing (NLP)
- Learn some classic and state-of-the-art techniques
 - We will focus on NLP problems and discuss recent advances in large language models (LLMs)
- Acquire hands-on skills for solving NLP problems
 - Even some research experience!
- Prepare for:
 - further study of NLP, AI, and related subjects (machine learning, robotics, etc)
 - Theoretical and application-driven work

Lectures and Labs/Discussions

- For lectures, we go over the central concepts and methods.
- For labs/discussions, emphases will be on:
 - Working through programming tasks and example problems
 - Extension of content introduced by lectures
 - Illustrations of how foundational concepts in class are being applied in the real world
- Both lectures and lab/discussion sections will be automatically videotaped and made available on Canvas.

Prerequisites

- Programming
 - Being able to write code in Python proficiently
- Courses
 - Algorithms
 - Probability
 - Supervised machine learning (optional but highly recommended)
 - Linear algebra (optional but recommended)

Prerequisites

Great notes on probability and statistics

- Probability and Statistics for Data Science, by Carlos Fernandez-Granda
- https://cims.nyu.edu/~cfgranda/pages/stuff/probability_stats_for_DS.pdf
- No need to be proficient in all aspects!

Textbook and References

- Main textbook
 - Dan Jurafsky and James H. Martin, "Speech and Language Processing, 2nd Edition", Prentice Hall, 2009.
 - We will also use materials from 3rd edition
 - <http://web.stanford.edu/~jurafsky/slp3/>
- Other references
 - Jacob Eisenstein, "Introduction to Natural Language Processing", The MIT Press, 2019

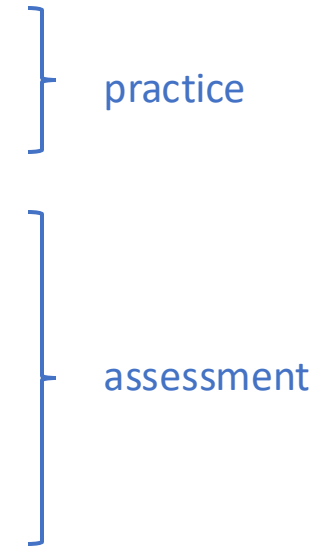
Topics of the Course (tentatively)

- Basic concepts
 - Text Normalization
 - Language Models
 - Text Classification
 - Syntax: Formal Grammars of English, Syntactic Parsing, Dependency Parsing
 - Semantics: Vector Semantics, Distributional Semantics, Word Embeddings
- Applications
 - Summarization
 - Question Answering
 - Sentiment Analysis
 - Machine Translation
 - Coreference Resolution
 - Discourse Analysis
- State-of-the-art
 - Transformers and large language models

AI Course Landscape at UM

- **EECS487: Introduction to Natural Language Processing**
- CSE595: Natural Language Processing
- EECS442, 542: Computer Vision
- EECS445: Introduction to Machine Learning
- CSE545: Machine Learning
- EECS492: Introduction to Artificial Intelligence
- CSE592: Artificial Intelligence Foundations
- CSE692: Advanced Artificial Intelligence
- Other arising courses in data mining, information retrieval, deep learning, and reinforcement learning, etc.

Grading

- Homeworks (44%)
 - 4 assignments, 11% for each
 - Project (16%): details come up
 - Quizzes (12%):
 - Lecture quizzes (8%): ten quick in-class tests, each of 1%; two with lowest grades will be dropped, and **no make-up**
 - Lab quizzes/assignments (4%): ten quick in-class tests, each of 0.5%; two with lowest grades will be dropped, and **no make-up**
 - Midterm exam (25%): open-book, **Mar 17, 5pm-7pm, no make-up**; mark it on your calendar!
 - Participation (3%): participating in-class discussions, interaction on Piazza (help your peers, address questions, share notes, etc)
- 
- The diagram uses blue brackets on the right side to group the grading components. A bracket labeled 'practice' groups the Homeworks (44%), Project (16%), and Quizzes (12%) items. A second bracket labeled 'assessment' groups the Lecture quizzes (8%), Lab quizzes/assignments (4%), Midterm exam (25%), and Participation (3%) items.

Homeworks

- Each homework
 - Written questions + programming questions
 - Covering several topics
 - Roughly 2-3 weeks between release and due
 - Start early! You can finish each question once the topic is covered.

Quizzes

- Lecture quizzes: weekly (roughly, e.g., with exceptions of holidays or breaks)
 - Happen at the beginning of the lecture, cover the content in the previous two lectures
 - For example, first quiz (Jan 15) will cover topics of Jan 8 and Jan 13
 - Easy questions, e.g., true or false, short answer
- Lab/Discussion quizzes: weekly (roughly)
 - Happen at the end of a section
 - Easy questions or simple programming tasks done individually or in group (GSI/IA will discuss in detail)
- Concrete arrangement can be found on the schedule spreadsheet (on Canvas)

Course Project

- An NLP-related project
- 3-4 students as a team

Course Project Grading

- The problem needs to be well-defined, useful, and practical.
 - Reasonable results and observations.
- We encourage you to tackle a research-driven problem.
 - Start by reproducing results in a paper.
 - Design new method(s) that potentially lead to better performance

Course Project

- Talk to the instructor and GSI/IA on project topics!
- Sample projects and proposals/reports will be provided on Canvas.
- How to find teammates?
 - Talk to your classmates and see if you share interests!
 - How to do it online: Post on piazza with your background (programming language and skills) + potential project ideas + your email contact, other students should feel free to reach out
 - We will enable the teammate searching on piazza

Course Project Grading

- Three reports
 - 1-page proposal (2%), due on Feb 17, at 11:59pm.
 - 2-page progress report, with code (4%)
 - 4-page final report, with code (6%)
- One presentation
 - In class (4%)

Audience Award

- Bonus points!
 - All teams vote for their favorite project(s) after presentation.
 - The team gets the most votes will be awarded with 1% bonus point!

Submission and Late Policy

- Programming language
 - Python
- All submissions are made on Gradescope in electronic format.


Submission and Late Policy

- Submissions turned in late will be charged 20 points (out of 100 points) off for each late day (i.e., 24 hours).
- Each student has a budget of **8 days in total** throughout the semester before a late penalty is applied.
- Late days are not applicable to presentations.
- Each group member is charged with the same number of late days, if any, for their submission (applied to proposal, progress/final reports).

Get in touch!

- All materials, syllabus, schedule, videos, etc can be found on Canvas.
- Office hours (starting the week of Jan 9)
 - Prof. Lu Wang: Wednesdays 4:15-5:15pm, BBB 3812
 - GSI Frederick Zhang: ~~Tuesdays 5-6pm~~, BBB 1637
 - GSI Kaijian Zou: Thursdays 11am-noon, BBB 1637
 - IA Gordon Lim:
 - Wednesdays 3:30–5:30 PM (Virtual) umich.zoom.us/j/97983202883 (Passcode: 410461)
 - Fridays, 1:30–3:30 PM, FMCRB Atrium (Area outside 1060 FMCRB)
 - If there's any change, it will be posted on Piazza beforehand.
- Piazza
 - <https://piazza.com/umich/winter2025/eecs487/home>
 - Sign up: <https://piazza.com/umich/winter2025/eecs487>
 - All course relevant questions should go here!

Today's Outline

- Welcome!
- Administrivia
-  • What is natural language processing?
- Text normalization

What is Natural Language Processing?

- Allowing machines to communicate with human
- Natural language understanding + natural language generation

What does it mean to understand a language?



- "Stop"
- "Turn it up"
- "Volume level 6"
- "Repeat that"
- "What can you do?"
- "Play some music"
- "Play music by [artist]"
- "Play dance music on YouTube"
- "Play KEXP radio on TuneIn"
- "Play the latest episode of Radiolab"
- "Pause"
- "Next song"
- "When's my first appointment tomorrow?"
- "Wake me up at 6am tomorrow"
- "Tell me about my day"
- "How long will it take to get to work?"
- "What's the weather today?"

What does it mean to understand a language?

Can you suggest a 2-day itinerary to visit New York City?

OpenAI's ChatGPT



Here's a compact yet comprehensive 2-day itinerary for New York City that captures iconic landmarks, cultural experiences, and local favorites. It's designed for first-time visitors but can be customized based on your preferences.

Day 1: Classic NYC Highlights

Morning:

1. **Breakfast:** Start at a classic NYC diner or café. Try **Balthazar** in SoHo for a French twist or **Russ & Daughters Cafe** for bagels and smoked fish.
2. **Statue of Liberty & Ellis Island:** Take the ferry from Battery Park to visit these iconic landmarks. If time is tight, consider a Staten Island Ferry ride for views of the Statue of Liberty without stopping.

Afternoon: 3. **Lunch:** Head to the Financial District and grab lunch at **Eataly Downtown** or a slice of NYC pizza at **Joe's Pizza**. 4. **9/11 Memorial & Museum:** Visit this moving site and learn about the events of September 11, 2001. 5. **Wall Street & Charging Bull:** Stroll through the Financial District and see landmarks like the New York Stock Exchange.

Evening: 6. **Brooklyn Bridge Walk:** Walk across the Brooklyn Bridge at sunset for breathtaking views of the skyline. 7. **Dinner in DUMBO (Brooklyn):** Dine at **The River Café** for upscale dining or try **Juliana's Pizza** for a casual meal. 8. **Night Views:** Head to **Brooklyn Heights Promenade** for panoramic views of Manhattan's skyline.

Day 2: Uptown & Midtown Adventures

Morning:

What does it mean to understand a language?

Write a short adventure story?

OpenAI's ChatGPT



The Forgotten Key

Deep within the heart of the Whispering Woods, where ancient trees murmured secrets to the wind, young Lyra knelt before a moss-covered stone. She brushed away the dirt to reveal a strange symbol—a crescent moon cradling a key. It matched the pendant her late grandfather had given her, a pendant she always wore but never understood.

The symbol glowed faintly as she held the pendant close. Suddenly, the ground beneath her shifted, revealing a hidden staircase spiraling downward. Lyra hesitated, but the thrill of adventure outweighed her fear. She descended into the unknown, her lantern casting flickering shadows on the walls.

The air grew cooler as she reached the bottom, where a massive iron door stood. It bore the same crescent-and-key insignia. Lyra placed her pendant into a small, key-shaped indentation, and with a deep rumble, the door swung open.

Inside was a cavern filled with shimmering crystals that reflected the lantern's light like a thousand tiny stars. At the center stood a pedestal holding an ancient tome, its cover bound in cracked leather. As Lyra approached, an ethereal voice echoed through the cavern.

"Only one with a pure heart may claim the knowledge within," it said. "Do you seek this power for yourself, or for the good of others?"

What does it mean to understand a language?

Phonology

Morphology

Lexemes

Syntax

Semantics

Pragmatics

Discourse

Sound waves



Words



Parse trees



Meanings

What does it mean to understand a language?

Phonology

Morphology

Lexemes

Syntax

Semantics

Pragmatics

Discourse

Shallower Analysis

Deeper Analysis

Syntax, Semantics, Pragmatics

- Syntax concerns the proper ordering of words and its affect on meaning.
 - The dog bit the boy.
 - The boy bit the dog.
 - Bit boy dog the the.
- Semantics concerns the (literal) meaning of words, phrases, and sentences.
 - “plant” as a photosynthetic organism
 - “plant” as a manufacturing facility
 - “plant” as the act of sowing
- Pragmatics concerns the overall communicative and social context and its effect on interpretation.
 - **Honest or dishonest?**
 - Context 1: Kyle and Ellen would like to see a movie. Kyle has \$20 in his pocket. Tickets cost \$8 each.
 - Context 2: Kyle and Ellen would like to see a movie. Kyle has \$20 in his pocket. Tickets cost \$10 each.
 - Kyle: “I have \$8.”

Where NLP is used?

Commercial World



amazon

Google

Microsoft[®]

Meta

Social World

- Disaster Relief
- Chatbots for Mental Health
- Detecting abusive language in online posts

Sentiment in Restaurant Reviews

A very bad (one-star) review:

The bartender... absolutely horrible... we waited 10 min before we even got her attention... and then we had to wait 45 - FORTY FIVE! - minutes for our entrees... stalk the waitress to get the cheque... she didn't make eye contact or even break her stride to wait for a response ...

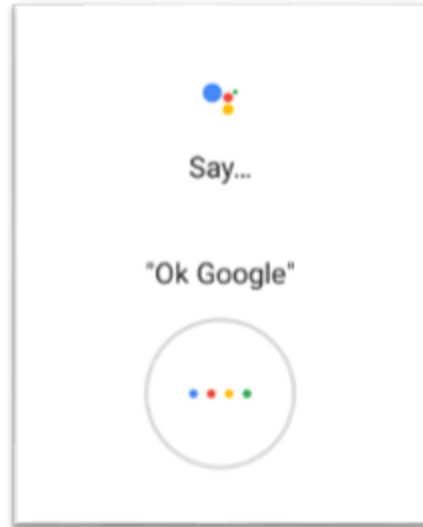
Dan Jurafsky, Victor Chahuneau, Bryan R. Routledge, and Noah A. Smith. 2014. Narrative framing of consumer sentiment in online restaurant reviews. First Monday 19:4

What is the language of bad reviews?

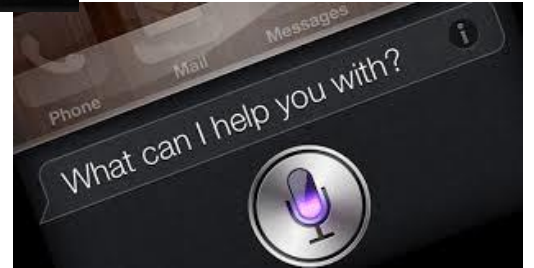
- Negative sentiment language
horrible awful terrible bad disgusting
- Past narratives about people
waited, didn't, was
he, she, his, her,
manager, customer, waitress, waiter
- Frequent mentions of **we** and **us**
... **we** were ignored until **we** flagged down a waiter to get **our** waitress
...

Personal Assistants

amazon alexa



Siri



Why NLP is challenging?

Ambiguity is Ubiquitous

- Speech Recognition
 - “recognize speech” vs. “wreck a nice beach”
 - “youth in Asia” vs. “euthanasia”
- Syntactic Analysis
 - “I ate spaghetti **with** chopsticks” vs. “I ate spaghetti **with** meatballs.”
- Semantic Analysis
 - “The dog is in the **pen**.” vs. “The ink is in the **pen**.”
 - “I put the **plant** in the window” vs. “Ford put the **plant** in Mexico”
- Pragmatic Analysis
 - From “The Pink Panther Strikes Again”:
 - Clouseau: Does your dog bite?
Hotel Clerk: No.
Clouseau: [*bowing down to pet the dog*] Nice doggie.
[*Dog barks and bites Clouseau in the hand*]
Clouseau: I thought you said your dog did not bite!
Hotel Clerk: That is not my dog.

Ambiguity

Find at least 6 meanings of this sentence:

I made her duck

Ambiguity

Find at least 6 meanings of this sentence:

I made her duck

- I cooked waterfowl for her benefit (to eat)
- I cooked waterfowl belonging to her
- I created the (plaster?) waterfowl she owns
- I caused her to quickly lower her head or body
- I recognized the true identity of her spy waterfowl
- I waved my magic wand and turned her into undifferentiated waterfowl

Ambiguity

I caused her to quickly lower her head or body

Part of speech: “duck” can be a Noun or Verb

I cooked waterfowl belonging to her.

Part of speech:

“her” is possessive pronoun (“of her”)

“her” is dative pronoun (“for her”)

I made the (plaster) duck statue she owns

Word Meaning : “make” can mean “create” or “cook”

Ambiguity is Explosive

- Ambiguities compound to generate enormous numbers of possible interpretations.
- In English, a sentence ending in n prepositional phrases has *over* 2^n syntactic interpretations
 - “I saw the man with the telescope”: 2 parses
 - “I saw the man on the hill with the telescope.”: 5 parses
 - “I saw the man on the hill in Texas with the telescope”: 14 parses
 - “I saw the man on the hill in Texas with the telescope at noon.”: 42 parses
 - “I saw the man on the hill in Texas with the telescope at noon on Monday”: 132 parses


Humor and Ambiguity

- Many jokes rely on the ambiguity of language:
 - Policeman to little boy: “We are looking for a thief with a bicycle.” Little boy: “Wouldn’t you be better using your eyes.”
 - Why is the teacher wearing sun-glasses. Because the class is so bright.
 - Groucho Marx: One morning I shot an elephant in my pajamas. How he got into my pajamas, I’ll never know.
 - She criticized my apartment, so I knocked her flat.
 - Noah took all of the animals on the ark in pairs. Except the worms, they came in apples.

Why is Language Ambiguous?

- Having a unique linguistic expression for every possible conceptualization that could be conveyed would make language overly complex and linguistic expressions unnecessarily long.
- Allowing resolvable ambiguity permits shorter linguistic expressions, i.e. data compression.
- Language relies on people's ability to use their knowledge and inference abilities to properly resolve ambiguities.
- Infrequently, disambiguation fails, i.e. the compression is lossy.

Some NLP Tasks

- 
- Syntactic Tasks
 - Semantic Tasks
 - Pragmatics/Discourse Tasks

Word Segmentation

- Breaking a string of characters into a sequence of words.
- In some written languages (e.g. Chinese) words are not separated by spaces.
- Even in English, characters other than white-space can be used to separate words [e.g. , ; . - : ()]
- Examples from English URLs:
 - jumptheshark.com \Rightarrow jump the shark .com
 - x.com/pluckerswingbar
 - \Rightarrow x .com pluckers wing bar
 - \Rightarrow x .com plucker swing bar

Part Of Speech (POS) Tagging

- Annotate each word in a sentence with a part-of-speech.

I ate the spaghetti with meatballs.

Pro V Det N Prep N

John saw the saw and decided to take it to the table.


PN V Det N Con V Part V Pro Prep Det N

- Useful for subsequent syntactic parsing and word sense disambiguation.

Phrase Chunking

- Find all non-recursive noun phrases (NPs) and verb phrases (VPs) in a sentence.
 - [NP I] [VP ate] [NP the spaghetti] [PP with] [NP meatballs].
 - [NP He] [VP reckons] [NP the current account deficit] [VP will narrow] [PP to] [NP only # 1.8 billion] [PP in] [NP September]

Some NLP Tasks

- Syntactic Tasks
-  • Semantic Tasks
- Pragmatics/Discourse Tasks

Word Sense Disambiguation (WSD)

- Words in natural language usually have a fair number of different possible meanings.
 - Ellen has a strong **interest** in computational linguistics.
 - Ellen pays a large amount of **interest** on her credit card.
- For many tasks (question answering, translation), the proper sense of each ambiguous word in a sentence must be determined.


Semantic Parsing

- A *semantic parser* maps a natural-language sentence to a complete, detailed semantic representation (*logical form*).
- For many applications, the desired output is immediately executable by another program.
- Example: Mapping an English database query to Prolog:
How many cities are there in the US?
answer(A, count(B, (city(B), loc(B, C),
const(C, countryid(USA))),
A))

Textual Entailment

- Determine whether one natural language sentence entails (implies) another under an ordinary interpretation.
- E.g., “A soccer game with multiple males playing. -> Some men are playing a sport.”

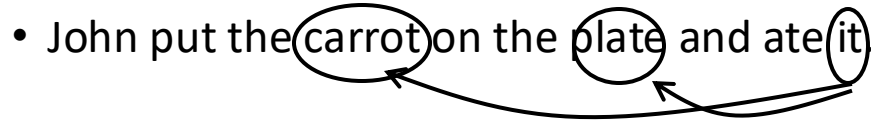
Some NLP Tasks

- Syntactic Tasks
- Semantic Tasks
-  • Pragmatics/Discourse Tasks

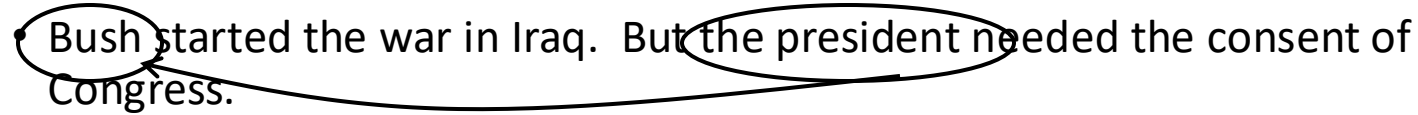
Anaphora Resolution/Co-Reference

- Determine which phrases in a document refer to the same underlying entity.

- John put the carrot on the plate and ate it.



- Bush started the war in Iraq. But the president needed the consent of Congress.



- Some cases require difficult reasoning.
 - Today was Jack's birthday. Penny and Janet went to the store. They were going to get presents. Janet decided to get a kite. "Don't do that," said Penny. "Jack has a kite. He will make you take it back."

More Application-driven Tasks

Information Extraction (IE)

- Identify phrases in language that refer to specific types of entities and relations in text.
- Named entity recognition is task of identifying names of people, places, organizations, etc. in text.

people organizations places

- Michael Dell is the CEO of Dell Computer Corporation and lives in Austin Texas.
- Relation extraction identifies specific relations between entities.
 - Michael Dell is the CEO of Dell Computer Corporation and lives in Austin Texas.
 - Michael Dell is the CEO of Dell Computer Corporation and lives in Austin Texas.

Question Answering

- Directly answer natural language questions based on information presented in a corpora of textual documents (e.g. the web).
 - Where is the very first McDonald's located?
 - San Bernardino, California
 - When was United Nations formed?
 - October 24, 1945

Text Summarization

- Produce a short summary of one or many longer document(s).
 - **Article:** An international team of scientists studied diet and mortality in 135,335 people between 35 and 70 years old in 18 countries, following them for an average of more than seven years. Diet information depended on self-reports, and the scientists controlled for factors including age, sex, smoking, physical activity and body mass index. The study is in The Lancet. Compared with people who ate the lowest 20 percent of carbohydrates, those who ate the highest 20 percent had a 28 percent increased risk of death. But high carbohydrate intake was not associated with cardiovascular death. ...
 - **Summary:** Researchers found that people who ate higher amounts of carbohydrates had a higher risk of dying than those who ate more fats.

Spoken Dialogue Systems -- Chatbots

- Q: Is it going to rain today?
- A: It will be mostly sunny. No rain is expected.



Machine Translation

- Translate a sentence from one natural language to another.
 - 我喜欢汉堡 → I like burgers.

Ambiguity Resolution is Required for Translation

- Syntactic and semantic ambiguities must be properly resolved for correct translation:
 - “John **plays** the guitar.” → “John **弹** 吉他”
 - “John **plays** soccer.” → “John **踢** 足球”

Ambiguity Resolution is Required for Translation

- Syntactic and semantic ambiguities must be properly resolved for correct translation:
 - “John **plays** the guitar.” → “John **弹** 吉他”
 - “John **plays** soccer.” → “John **踢** 足球”
- An apocryphal story is that an early MT system gave the following results when translating from English to Russian and then back to English:
 - “The spirit is willing but the flesh is weak.” → “The liquor is good but the meat is spoiled.”
 - “Out of sight, out of mind.” → “Invisible idiot.”

Bias and Ethics



Bias and Ethics



Resolving Ambiguity

- Choosing the correct interpretation of linguistic utterances requires (commonsense) knowledge of:
 - Syntax
 - An agent is typically the subject of the verb
 - Semantics
 - Michael and Ellen are names of people
 - August is the name of a month (and of a person)
 - Toyota is a car company and Prius is a brand of car
 - Pragmatics
 - Some social norm, communicative goals
 - Asking a question, expecting an answer
 - World knowledge
 - Credit cards require users to pay financial interest
 - Agents must be animate and a hammer is not animate

State-of-the-Arts

- Large language models
 - Trained from a massive amount of data
 - Achieved impressive performance on all NLP tasks

Superhuman AI

GPT-4 scored in the 90th percentile of the bar exam with a score of 298 out of 400.

ChatGPT AI passes the medical licensing examination in the US

GPT-4 aced the SAT Reading & Writing section with a score of 710 out of 800, which puts it in the 93rd percentile of test-takers.

OpenAI's new o1 models push AI to PhD-level intelligence

Reasoning

Math

Let n be an even positive integer. Let p be a monic, real polynomial of degree $2n$; that is to say,

$$p(x) = x^{2n} + a_{2n-1}x^{2n-1} + \dots + a_1x + a_0$$

for some real coefficients a_0, \dots, a_{2n-1} .

Suppose that $p\left(\frac{1}{k}\right) = k^2$ for all integers k such that $1 \leq |k| \leq n$.

Find all other real numbers x for which $p\left(\frac{1}{x}\right) = x^2$.

Chemistry

What is the pH of a 0.10 M solution of NH_4F ?
The K_a of NH_4^+ is 5.6×10^{-10} and the K_a of HF is 6.8×10^{-4} .

Coding

Write a bash script that takes a matrix represented as a string with format '[1,2],[3,4],[5,6]' and prints the transpose in the same format.

```
1  #!/bin/bash
2
3  input="$1"
4
5  # Remove any spaces
6  input="${input// /}"
7
8  # Split input into rows
9  IFS=']' read -ra rows << "$input"
10
11 # Initialize an array to hold the matrix
12 declare -a matrix
13 num_rows=0
14
15 for row in "${rows[@]"; do
16     # Remove leading commas and brackets
17     row="${row#','}"
18     row="${row# '['}"
19     row="${row//']/ '}"
20
21     # Skip empty rows
22     if [ -z "$row" ]; then
23         continue
24     fi
25
```

[Examples are from openai.com]

Health

Make a diagnosis based on the following report:

Phenotypes:

- Intellectual disability
- Global developmental delay
- Macrodonia
- Triangular face
- Thick eyebrow
- Abnormality of the hand
- Short stature
- Motor delay
- Delayed speech and language
- Feeding difficulties

LONDON, Feb 8 (Reuters) - Alphabet Inc ([GOOGL.O](#)) lost \$100 billion in market value on Wednesday after its new chatbot (Bard) shared inaccurate information...



what new discoveries from the James Webb Space Telescope can I tell my 9 year old about?

Your 9-year old might like these recent discoveries made by The James Webb Space Telescope (JWST):

- In 2023, The JWST spotted a number of galaxies nicknamed “green peas.” They were given this name because they are small, round, and green, like peas.
- The telescope captured images of galaxies that are over 13 billion years old. This means that the light from these galaxies has been traveling for over 13 billion years to reach us.
- JWST took the very first pictures of a planet outside of our own solar system. These distant worlds are called “exoplanets.” Exo means “from outside.”

These discoveries can spark a child's imagination about the infinite wonders of the universe.

NEW YORK, June 22 (Reuters) - A U.S. judge on Thursday imposed sanctions on two New York lawyers who submitted a legal brief that included six fictitious case citations generated by an artificial intelligence chatbot, ChatGPT.





In an 800 word essay, compose an argument that attempts to situate Ferris Bueller's Day Off as an existentialist text. Use specific evidence from the materials we have discussed, and make explicit comparisons or connections between character(s), setting, and/or themes in both Ferris Bueller's Day Off and The Metamorphosis.



Ferris Bueller's Day Off is a film that can be interpreted as an existentialist text, with its themes of individuality, freedom, and the search for meaning in life. This can be seen through the character of Ferris, who represents the idea of individual revolt against societal norms and expectations. In the opening scene, Ferris addresses the audience directly, telling them that he is "not going to sit on [his] ass as the events that affect [him] unfold to determine the course of [his] life." This is a clear rejection of the idea that one's life should be determined by outside forces, and instead asserts the individual's right to make their own choices and determine their own path.

[Source: The Wall Street Journal]

"got three out of six on the assignment, which according to the AP rubric, is in the B- to C range."

Factual errors:

- Incorrect attribution of quote
- Wrong information

Who Answers It Better? An In-Depth Analysis of ChatGPT and Stack Overflow Answers to Software Engineering Questions

Samia Kabir, David N. Udo-Imeh, Bonan Kou, Tianyi Zhang

“we undertook a comprehensive analysis of ChatGPT's replies to 517 questions from Stack Overflow”

*“Our examination revealed that **52%** of ChatGPT's answers contain inaccuracies”*

Related Fields

- Artificial Intelligence
- Machine Learning
- Linguistics
- Cognitive science
- Logic
- Data science
- Political science
- Education
- Economics
- ...many more

Relevant Scientific Conferences and Journals

- Association for Computational Linguistics (ACL)
- North American Association for Computational Linguistics (NAACL)
- Empirical Methods in Natural Language Processing (EMNLP)
- International Conference on Computational Linguistics (COLING)
- Conference on Computational Natural Language Learning (CoNLL)
- Transactions of the Association for Computational Linguistics (TACL)
- Journal of Computational Linguistics (CL)