

Research Methods in computer science

Spring 2026

Lecture 1

Omprakash Gnawali

January 21, 2026

Class Introduction

Introduction

Name

Research Topic/Group/Advisor

Year(s) at UH

Undergrad institution/country/city

Why do a PhD?

Some possible reasons

- Like research

- Want to get a research/faculty job

- Learn how to read and write

- Leadership in technology

- Acquire analytical and technical skills

Objective

Learn how research is done in computer science

Improve research productivity

Topics Covered

Papers: Read, write, evaluate

Presentations: create, perform, evaluate

Other topics

- Research thinking

- Graphs and visualization

- Tools

- Statistics and data analysis

- Experiment design

- Ethics, Intellectual property, and startups

CS Research in the Post-AI World

How AI is being used in Computer Science?

How Computer Science is changing due to AI?

How to use AI in Computer Science Research?

Who Should Take this Course?

Ph.D. students in early career

MS Thesis/research students

Must have a research topic in mind!

Guest Lectures

Other faculty and experts in research, writing, presentation will come to the class to share their ideas.

Important to understand different views and emphasis. They may be your co-advisor, peers, or dissertation committee member.

Administrative Information

3 credits

COSC 6321/6110 is a PhD requirement

Meet Mondays/Wednesdays 1-230pm at S 116

Office hours: Mondays 230-330pm by Appointment

<https://www2.cs.uh.edu/~gnawali/courses/cosc6321-s26/>

Lectures

Lectures are done in-person

Some guest lectures may be online

Alignment with PhD student activities run by the department

Grading

Pass/Fail

To Pass

- Submit all homework

- Each homework graded 0 or 1

- Their presentations in the class.

- We will do some HW in the class from scratch.

- Average grade must be > 0.8

- Participate in activities (conference, etc.)

Logistics

Most HW submission on Teams

We will use specialized platforms for specific exercises

Discussions/messages on Teams

Topics for today

PhD and Research

What skills do we need to be successful?

Get a PhD.

Get a job.

PhD Skills?

What skills do we need to do a PhD?

To become a good researcher

To become an effective and productive technologist

Research Skills in Post-AI World

Tool use to improve productivity, quality, ...

Some aspects of communication

Judgment and decision-making

Verification [at least for now]

...

Research

Research comprises "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humans, culture and society, and the use of this stock of knowledge to devise new applications." It is used to establish or confirm facts, reaffirm the results of previous work, solve new or existing problems, support theorems, or develop new theories.

<https://en.wikipedia.org/wiki/Research>

Some research is theoretical and involves developing and analyzing new algorithms and techniques and some is more applied and involves experiments, design, implementation, and testing. In every case, research is an enterprise of intellectual exploration that seeks to advance our field.

<http://conquer.cra.org/students/what-is-research-in-computer-science>

Computer Science Research

It is a little different from what that wikipedia article says

We build new artifacts

What are the desirable properties?

How does it perform?

How well does it solve the problem?

Closer to engineering than natural sciences

Assignment 1

Please describe two topics of interest in Computer Science, one in your area of research and one related to the metaverse. Each paragraph must have:

Title

Clear and short explanation of the topic, understandable to a ***broader*** CS audience.

Reason why the idea is interesting