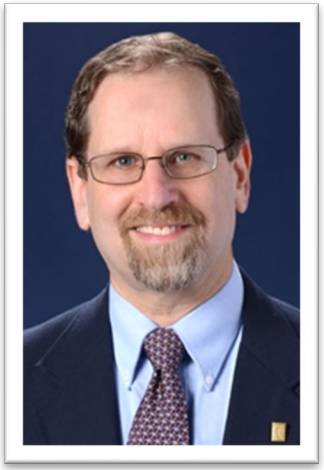
GETTING STARTED: COMPUTER SCIENCE INDEPENDENT WORK

SPRING 2025

DR. ROBERT FISH, DR. AARTI GUPTA,
& MIKKI HORNSTEIN

WELCOME!



Robert Fish
IW Coordinator
rfish (@cs.princeton.edu)
037 Corwin Hall

Aarti Gupta
IW Coordinator
aartig (@cs.princeton.edu)
220 Computer Science

Mikki Hornstein
IW Administrator
mhornstein (@princeton.edu)
212 Computer Science

OUTLINE FOR THIS SESSION

- Outstanding IW Awards – Fall 2024
- Overview of independent work in Computer Science
- Details of important steps and deadlines
- Resources for more information and help

CONGRATULATIONS!

Exemplary Fall 2024 Independent Work

Jessica Dong, BSE'25
Predicting Disparities in Health Care Out-of-pocket Costs
Adviser: Xiaoyan Li

Alice Hou, BSE'26
Predicting Optogenetic Cell Migration with Contrastive RL
Adviser: Benjamin Eysenbach

Caiden Kiani, BSE'25
Baha'i Semantic Search Engine - Vector Database for Baha'i Texts
Adviser: Christiane Fellbaum

Keith Matanachai, BSE'26
Predicting CRISPR-based Prime Editing Efficiency Using Machine Learning
Adviser: Yuri Pritykin

Conor McKenna, BSE'26
Verd: A Soulslike Rock Smasher Game
Adviser: Marcel Dall'Agnol

Kaan Odabas, BSE'25
COS-Bench: A Convex Optimization Solver Benchmarking Framework
Adviser: Bartolomeo Stellato

Joy Patterson, BSE'25
Homeward DAO: Blockchain for Equitable Real Estate Investment
Adviser: David Walker

Kevin Wang, BSE'25
Scaling up Reinforcement Learning via Deep Contrastive RL for Goal-Conditioned Robotic Tasks
Adviser: Benjamin Eysenbach

LET’S GET STARTED!

What Is Independent Work?

- Independent Work (IW):
  An individual project to study an idea in depth.
- Examples:
  - Algorithm
  - System design
  - Problem formulation
  - Benchmark suite
  - Proof of a theorem
  - Application
  - Investigate a dataset
  - Etc…

Why Do Independent Work?

- Study a topic in depth
  - Dive into much more detail than is possible in a course
- Learn important skills
  - Technical writing, speaking, project management
- Work closely with faculty
  - Meet weekly, get advice, get to know them, etc.
- Do something interesting to talk about in…
  - Grad applications, job interviews, etc.
- Have fun!!

Types of Independent Work

- Fall Term Project
  - Some BSE juniors/seniors
  - Designed for one term, but can be followed by a related project in a later term
  - IW seminar, or one-on-one/individual advising
- Two-Term/Thesis
  - All AB seniors and some BSE juniors/seniors
  - Designed for a full year
  - One-on-one/individual advising

IW Seminars

- Same as one-on-one projects, but students work on related topics and meet with an advisor together.
  - Enables collaborative projects
  - Enables sharing of infrastructure
  - Enables feedback to/from other students
- Targeted at first-time IW students
  - Provides more help on how to choose good projects, how to manage time, how to design talks, how to write papers, etc.

Important Steps and Deadlines: Spring 2025 Projects

February 14:	SEAS Funding Application due, 5:00pm
February 20:	Written Project Proposal due, 11:59pm
March 6:	Checkpoint Form due, 11:59pm
March 25:	Attend How to Give an IW Talk
April 1:	Attend How to Write an IW Paper (*note: date changed from what was originally posted)
April 15:	Oral Presentation Slides & Link to Video due, 11:59pm
April 27:	Written Final Report due, 11:59pm

https://www.cs.princeton.edu/ugrad/calendar-and-requirements

QUESTIONS SO FAR?

Onto the specifics…

Written Project Proposals

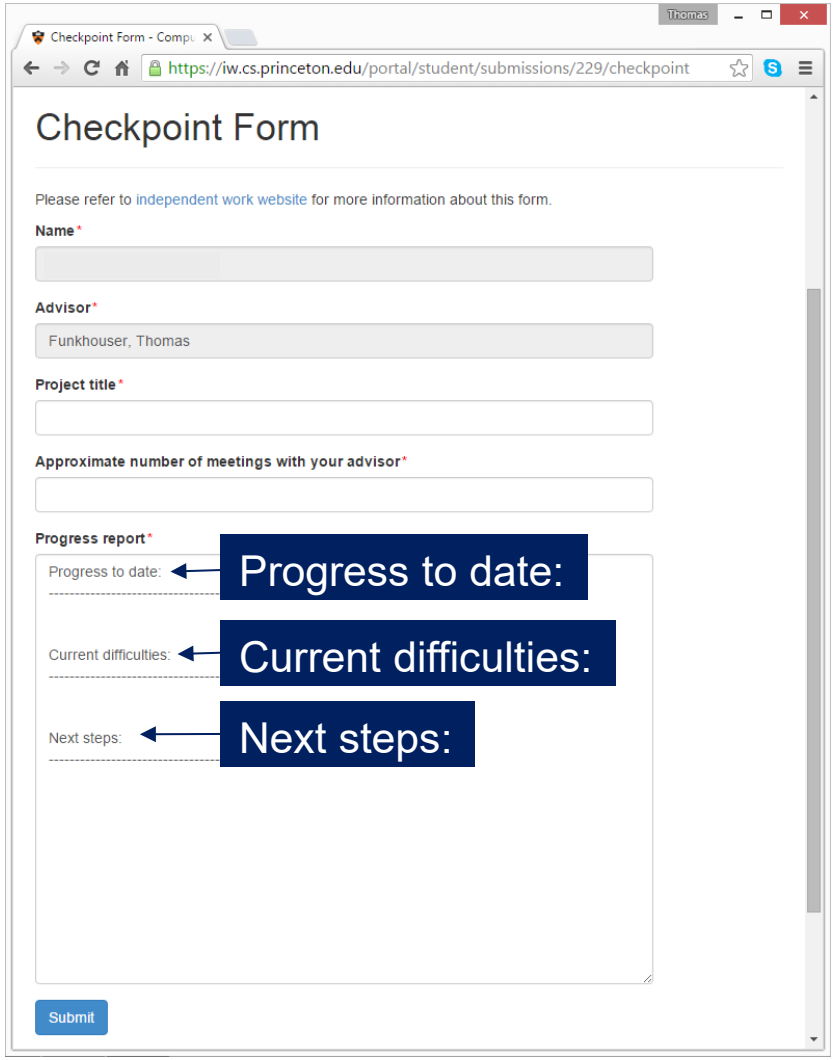
- Submit a written description of your project plan
- Logistics:
  - Due February 20, 11:59pm Eastern
  - 1-2 page paper
  - Submit PDF document via IW portal

Written Project Proposal (Continued)

- Motivation and goal
  - “The goal of my project is…”
- Related work
  - Survey of prior work with similar goals
- Approach
  - Key novel idea
- Implementation plan
  - Things you plan to implement
- Evaluation Plan
  - Experiment design, data, metrics, comparisons

Checkpoint Form

- Write a short summary of what is done in the first half, and what is planned for the second half
- Logistics:
  - Due March 6, 11:59pm EDT
  - Write two paragraphs
  - Submit via IW portal
  - Get feedback from advisor


Thomas
Checkpoint Form - Compu
https://iw.cs.princeton.edu/portal/student/submissions/229/checkpoint
Checkpoint Form
Please refer to independent work website for more information about this form.
Name*
Advisor*
Funkhouser, Thomas
Project title*
Approximate number of meetings with your advisor*
Progress report*
Progress to date:
Current difficulties:
Next steps:
Progress to date:
Current difficulties:
Next steps:
Submit

Oral Presentation
(Fall-Term Students Only)

- Give a **nine-minute** talk about what you've done over the whole term
  - Required for all seminar students, and any first-time BSE students.
- Logistics:
  - Attend "How to Give an IW Talk" on March 25
  - Submit slides and video link via IW portal by April 15 at 11:59pm
    - Note: You must submit your FULL slide deck by the deadline above

Oral Presentation (Continued)

- Video-recorded oral presentations
  - Record your oral presentation via Zoom, or
  - Select another way to record your oral presentation (Loom, etc.)
- Save your recording either on Zoom or in Google Drive
  - Submit a **link** to your recording to the IW portal
- Submit a pdf of your slides to the IW portal
- Seminar students: your instructor may ask you to practice or present in your group meeting, as well
- One-on-one students: your adviser may ask you to present to their research group, as well

Oral Presentation (Continued)

- Motivation and goal
  - “The goal of my project is…”
- Related work
  - Survey of prior work with similar goals
- Approach
  - Key novel idea
- Implementation plan
  - Things you implemented. How did you do it? What remains to be done?
- Evaluation
  - Experiment design, data, metrics, comparisons, qualitative results, quantitative results, further results needed
- Discussion
  - Conclusions, limitations, future work

Written Final Report

- Submit a written description of your project, including results and conclusions

Logistics

- Due April 27 by 11:59pm
- Attend “How to Write an IW Paper” on April 1
- Submit PDF via IW portal
- 20-25 pages, double-spaced, plus appendix

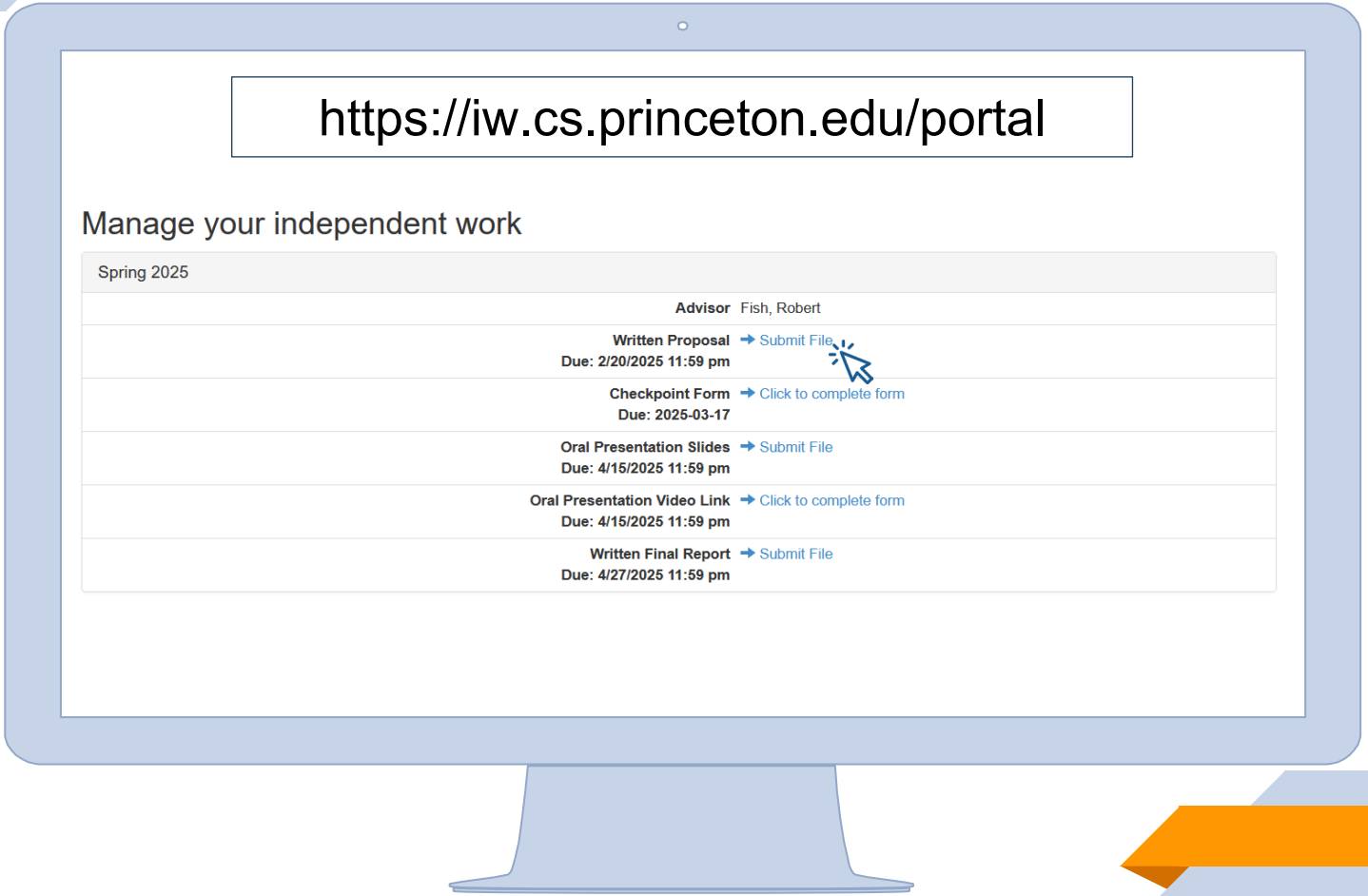
Final papers submitted after 11:59pm on the due date will be assigned a 1/3 grade deduction.

Written Final Report (Continued)

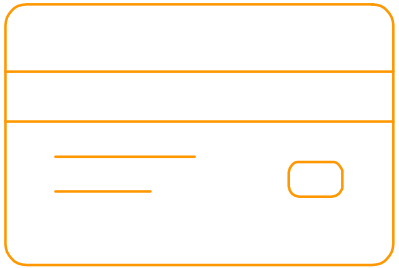
- Motivation and goal
  - “The goal of my project is…”
- Related work
  - Survey of prior work with similar goals
- Approach
  - Key novel idea
- Implementation
  - Things you built. How did you do it? ~~What remains to be done?~~
- Evaluation
  - Experiment design, data, metrics, comparisons, qualitative results, quantitative results, ~~further results needed~~
- Discussion
  - Conclusions, limitations, future work

Additional Important Information

https://iw.cs.princeton.edu/portal



Funding



- Project-related expenses:
  - Unusual hardware, software, data sets, etc.
- Available funds:
  - School of Engineering and Applied Science: Application due February 14
    - Requires an adviser signature, **don't procrastinate!**
  - Support up to ~$500 or more with justification ($300 max for cloud computing services)
  - Open to ANY computer science student
  - Student Activities Funding Engine (SAFE)
    - http://www.princeton.edu/studentfunding

Collaboration

- **INDEPENDENT** Work
  - Every student must do their own project
- Collaboration
  - Multiple IW projects can be synergistically part of a larger effort, either with other IW students, or grad students
  - Each student must carve out a distinct part with a clear goal, novel idea, evaluation methodology, etc.
  - Each student must submit their own work
  - Each student will be graded separately

Grading

- IW must be taken for a grade
- Grades are recommended by instructor, confirmed by IW Coordinators

- Grades will depend upon:
  - Student initiative and contribution: the creativity and originality of student ideas and/or degree of technical challenge undertaken
  - Student progress: content, amount of work accomplished to date, clarity and polish of presentations
  - Student presentation and paper: content, eloquence, organization and clarity

Grading (Continued)

- Majority of grade will depend upon quality of work and presentation
  - Poor presentation and/or missing checkpoints will also have an impact
- **Final papers submitted after 11:59pm on the due date will be assigned a 1/3 grade deduction.**

Grading (Continued)

- A-level
  - Clear contribution – interesting, creative
  - Solid execution and results – refined and tested
  - Excellent talks, papers – thoughtful, thorough
  - Student has taken initiative and led project
- B-level
  - Not-so-innovative – possibly obvious from previous work
  - Working execution and results – not fully refined and tested
  - Complete papers and talks – limited insights

Grading (Continued)

- C-level
  - Not innovative
  - Unfinished or not working implementation
  - Report looks like workbook or lab report
- D-level
  - Nothing interesting attempted, nothing gained
  - Report is stream of consciousness

Common Mistakes

- Mistake: Delaying project planning until last minute
  - Instead: Get started right away
- Mistake: Postponing meetings with your advisor
  - Instead: Try to meet once a week, even if it’s a brief meeting
- Mistake: Allowing yourself to get stuck
  - Instead: Talk to your advisor; don’t avoid them when you are stuck
  - TAs are usually assigned to every seminar. Use them!

Common Mistakes (Continued)

- Mistake: Putting off work until the end of the term
  - Instead: Work consistently during the term (10 hours per week, minimum)

- Mistake: Preparing papers and presentations at the last minute
  - Instead: Iteratively refine. Get feedback from your advisor.

If You're Having Trouble…

- Examples:
  - If you expect to miss a deadline
  - If you have problems with your advisor
  - If you have problems with your project
  - Other factors in your life (e.g. illness, death in the family, etc.)
- If you tell us early, we might be able to help you
  - We can direct you to the right person
- Fixing problems post facto may be much harder
  - Often involves Deans, etc.

Who/What You Can Ask

- Your Advisor:
  - Anything research related
  - Not: “Can I skip the project proposal or final paper?”
- IW Coordinators (Dr. Fish, Dr. Gupta)
  - Anything about mandatory requirements
  - Not: “Is this research interesting?”
- IW Administrator (Mikki Hornstein)
  - Anything about dates, forms, funding, etc.
  - Not: “Can you give me an extension?”

How to Ask Questions

- Canvas/Ed – Primary Resource
  - https://princeton.instructure.com/courses/18468
  - https://edstem.org/us/courses/75133/discussion
  - Ask IW staff and other students questions about logistics, advice, toolkits, data sets, etc.
- Email Mikki
  - mhornstein (@princeton.edu)

Where to Find More Information

- IW Website:
  - https://www.cs.princeton.edu/ugrad/independent-work-thesis
    - Calendar and Requirements
- IW Handbooks:
  - AB Handbook: https://www.cs.princeton.edu/sites/default/files/2024-09/cos-ab-iw-handbook-2024-25.pdf
  - BSE Handbook: https://www.cs.princeton.edu/sites/default/files/2024-09/cos-bse-iw-handbook-2024-25.pdf

Note: These slides will also be available on the website and Canvas

That pretty much covers it.

Let’s summarize the key points…

Immediate Next Steps

- Look over the IW website, IW handbooks, and be aware of important upcoming deadlines
- One-on-one students: Schedule weekly meetings with your advisor

What to Do in January/February?

- Work diligently to develop your project plan
  - Work hard to define a specific goal
  - Understand all related work
  - Articulate what makes your project novel
  - Know what software and data you will use
  - Have a good idea of what you need to implement
  - Have a specific plan to evaluate your results
- Write your project proposal early, get feedback, and refine multiple times.

But the Term Just Started!

- The first few weeks are really important…
  - A good project plan is key to success
  - It takes time to understand related work, relevant software, and available data sets
  - It take iteration and refinement (multiple meetings with your advisor) to define a good project goal and novel approach
  - Working hard in the first few weeks greatly reduces the chances of ending up with a weak project

My Thoughts on IW at Princeton

- This is your chance to do an in-depth project on a novel topic of your own choosing
  - It doesn't get better than this
  - It's probably why you came to Princeton
  - It's certainly what you'll remember most from your academic career at Princeton
- Take the initiative and BE AWESOME!

THANKS!

Any questions?