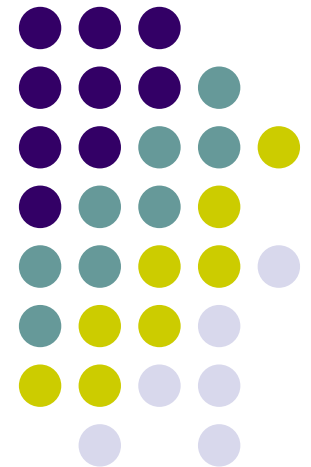
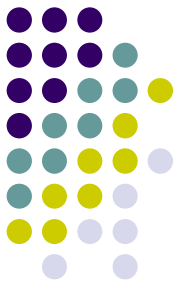


CS Independent Work Getting Started

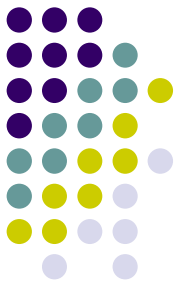
Moses Charikar
Spring 2006
Princeton University





Outline

- What is independent work/research ?
- Schedule and course work
- Tips for effective communication
- Summary
- Faculty presentations



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What is Independent Work ?



- Exposure to research
- Opportunity to work with faculty and graduate students
- So, what is research ?
 - Formally: advance state of art
 - Informally: tell people something new

What is Research and what is not ?



- Building a web site
- How do you distinguish yourself from a high school kid writing a bunch of code ?
- Make it
 - general: can be created and configured from parameters and scripts
 - automatically testable and demoable
 - comparison between competing implementation technologies (different languages, databases, OS environments)
 - a software engineering exercise in portability, robustness, performance, interface design
- Use the stuff you learn in your CS classes !

What is Research and What is Not?



- Research
 - Many other possibilities
- So, what is research ?
 - Formally: advance state of art
 - Informally: tell people something new
 - Not necessarily much much more work
 - Just need to “go the extra mile”

Other traits of a Good Project



- Interesting/important problem
- Non-trivial challenge(s)
- Exploration of new technology
- Can be finished in allotted time
- Effective communication (talks, reports)



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Who does Independent Work ?



- AB students
 - Junior independent work (JIW) for two semesters
 - Senior independent work (SRT) for two semesters
 - Automatically registered

Who does Independent Work ?



- BSE students
 - At least one semester during junior or senior year
 - Encourage more than one semester (2nd semester counts as departmental)
 - Juniors: COS 397 in Fall, COS 398 in Spring
 - Seniors: COS 497 in Fall, COS 498 in Spring

Independent Work Schedule

(COS 398, COS 498, COS JIW)



- By 2/22: Project plan
 - Find an advisor and a project
 - Fill out at “Independent Work Project Form”
 - Register online
- 2/28 - 3/2: Project proposal talks
 - 5 minute presentations to students and prof.
- During the project
 - Work 10-15 hours per week
 - Meet regularly with your advisor

Independent Work Schedule

(COS 398, COS 498, COS JIW)



- 3/27: Project checkpoint
 - 4-5 slides report progress and remaining plan
- 4/24 – 4/27: Project results talk
 - 13 minute presentation to students and profs.
- 5/8: Final written report

Independent Work Schedule

(COS SRT and BSE Thesis)



- 2/27: 2nd reader due
- 3/17: Project checkpoint
 - 4-5 slides report progress and remaining plan
- 4/10: 1st draft of thesis due
- 4/24 – 4/27: Project results talk
 - 13 minute presentation to students and profs.
- 5/8: final thesis due

Find an Advisor and a Project



- Get info about profs' research
 - Independent work page, home pages, research papers, word of mouth, ...
- Schedule meetings with several professors
 - email, office hours, appointments
- Choose a professor
 - Must be from CS dept
 - Can work with someone outside CS,
If you'd like to do this, consult with me
 - Can be jointly advised by someone else
- Profs on sabbatical: Andrew Appel

Find an Advisor and a Project



- Decide on a project
 - Profs suggest choices
 - Students come up with their own
 - A combination
 - Mutual agreement, interest, enthusiasm
- Submit “Independent Work Project Form” and register online

Find an Advisor and a Project



- Past popular topics/areas that may not be obvious research areas of profs:
 - Game playing (appel, schapire)
 - Education aids (bwk, wayne)
 - Language recognition/translation (bwk, schapire)
 - Wireless (dpd)
 - Display wall (li)
 - Cross-discipline (econ, history, math, psych, wws/politics, sociology, etc.) (bwk, ken, wayne, aslp)



Project proposal talk

- Problem description
 - What am I going to do
 - Why is it important
 - Why is it hard
- Approach
 - Previous approaches
 - My approach
 - Why is mine better



Project Proposal Talk

- Methodology, milestones, deliverables
 - Specific steps
 - What steps/deliverables will be done by checkpoint
 - What other steps/deliverables will be done by end of semester
 - What might be hard and what's the fall-back plan
- Summary

Project Proposal Talk



- Don't have to talk about everything
- But include everything (in “notes” section or other places)
- Be specific, give details of plan
- Tell me what's the new/clever/cool nugget
- Proposal talk is **not** your starting point: much preliminary work should have gone into the project by then

Project Proposal Talk and Beyond



- Scope
 - Not too little
 - Not too much (carve out a subpiece, limit functionality, reduce measurements)
 - If you're ambitious, have a longer term plan but the short term plan should still be doable
 - Don't be afraid of negative results
 - Have intermediate results

Project Proposal Talk and Beyond



- Be conscientious
 - Start early
 - Define small milestones for yourself
 - Work continuously to meet milestones
 - Meet with your advisor regularly
 - Don't hesitate to get help

Project Checkpoint



- 4-5 slides
- What you proposed to have done by checkpoint
- What you have actually accomplished by checkpoint
 - Steps
 - Deliverables
- Difficulties/surprises/deviations ?
- What more do you expect to do
 - Steps
 - Deliverables

End-of-Semester Talk



- Review the problem description and proposed approach – give “the theme”
- Give details (e.g., of implementation) to support “the theme”
- Give key results to support “the theme”
- Summarize “the theme”

End-of-Semester Report



- Introduction
 - Background
 - Problem description: include goal
- Approach
 - Previous approach(es)
 - My approach
 - Why is mine better
- Detailed description of methodology or implementation

End-of-Semester Report



- Experimental results
 - Analyze/interpret data, don't just give numbers
 - What does this have to do with your theme?
- Conclusion
- Acknowledgements and bibliography

Grading



- Project form/registration: 1%
- Proposal talk: 7%
- Checkpoint: 7%
- End-of-semester talk: 15%
- End-of-semester report (may include “participation”, “draft”, “general quality/difficulty of work, etc.): 70%

- No grade inflation !
- All steps count



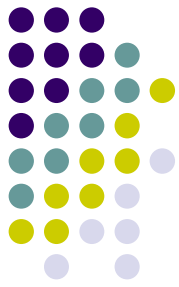
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Effective Writing

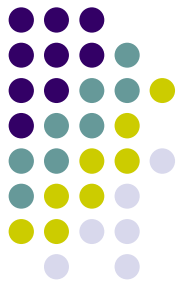


- Concepts
 - Focus on key ideas
 - Expose, weave it in the body, conclude
 - Why, not what
 - Don't get trapped by details and artifacts
- Flow: be a good story teller
 - Pay attention to order, and smooth transitions



Effective Writing

- **Simplicity**
 - Simple exposition, simple styles
 - Make it intuitive rather than formal
 - Be specific, use examples
- **Pitfalls**
 - Too vague: for example, no examples
 - Contributions non-obvious
 - Too much “what”, not enough “why”



Talk Tips

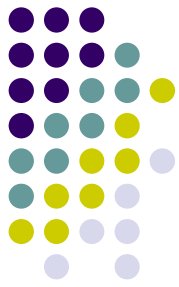
- Focus on key ideas
- Choose carefully a sub-story out of a full story
- Understand the nature of oral communication (no pause, no rewind)
- KISS principle (Keep It Simple, Stupid)
- Repetition is useful
- Give outline: some amount of predictability is comforting



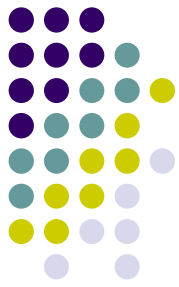
Talk Tips

- Explain, interpret, justify, not just describe
- Write large
- Use color, but sparingly, consistently
- Use pictures (and even animations)
- No full sentences (just terse outline)
- Make the sub-story coherent and self-contained
- One corollary: no standalone graphs

Talk Tips - Preparation

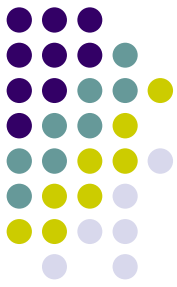


- Practice
- Dry run followed by slide-by-slide analysis
- Pay attention to time and practice for time
- Practice for varying audience backgrounds



Talk Tips – Presentation

- Speak clearly, make eye contact
- Don't read slides
- Pay attention to posture
- Eye contact, shift gaze
- Plan on shedding slides
- Admit shortcomings, don't wait for questions
- Analogies and jokes and help



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Summary



- What is research ?
 - Teaches people something new
- Course work
 - Be conscientious and stick to a plan
- Effective communication
 - Stick to a theme and tell a good story

Suggestions for projects



- Szymon Rusinkiewicz:

“I am looking for a student to work on a project proposed by James Gould of EEB. This involves automating some experiments on Siamese fighting fish: the fish are in an aquarium and depending on certain choices they make receive either positive or negative reinforcement (involving turning lights on and off). The project would be to automate the running of this experiment, using a camera to track the fish.”

Suggestions for projects:



- Kevin Wayne:
I have a contact from Classics who's interested in a kind of data visualization project involving social inequality. Seems like it could make an interesting JP, perhaps co-advised by me and someone from Sociology. I told him I'd try to pitch it at the JP meeting.

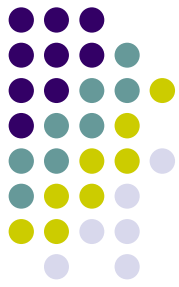
Suggestions for projects



- Andrea LaPaugh

“I am interested in having IW students. I don't have any specific projects to advertise -- just what's in my entry on the "suggested topics" handout. I am also interested in working with students who have their own topic if it is in the area of information search or management, broadly taken.”

Suggestions for projects



- Kenneth Steiglitz:

“I have a very specific proposal for some IW. There's an empty display case, quite large, in the Friend Center, and I suggested to Anca N. Niculin, the Graduate Affairs Coordinator for SEAS, that an interactive display, with a keyboard and screen, that simulated cellular automata would be snappy and attract attention.

To start, I have in mind something like a universal CA, maybe a 2-d billiard-ball computer al la Fredkin and Toffoli, and maybe also the 1-d Cook-Wolfram Rule 110. Or the Game of Life? Of course, the nice thing is that once the display is in place and working, anything is possible -- after all it's a Turing-complete display case.”