

Term Projects: Why They Matter and How to Get it Right

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Why is this the most wonderful time to be in computer science?

- Hardware innovations
 - At scales, big and small
- Big Data
 - Datasets are available in nearly all domains
- Model-fitting algorithms and open-source implementations
- What's the next disruption on the horizon?
 - 30 billion IoT devices this year
 - A trillion over the next 10 years

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Two sides of the same learning coin ...

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Assignments ...

- Focused mastery of a technical skill
 - Emphasis on skills that are deemed important for the particular course
- Training wheels are still on
- Constrained problem space
- Often comprehensively specified
 - Do this, then that, etc.

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A term project is ...

- Not your typical programming assignment
 - You have a lot of freedom and power
- Not done in isolation
 - Scale precludes this
- Not a duplication of what someone else has done
 - Not innovation!

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With great power comes great responsibility.
Voltaire

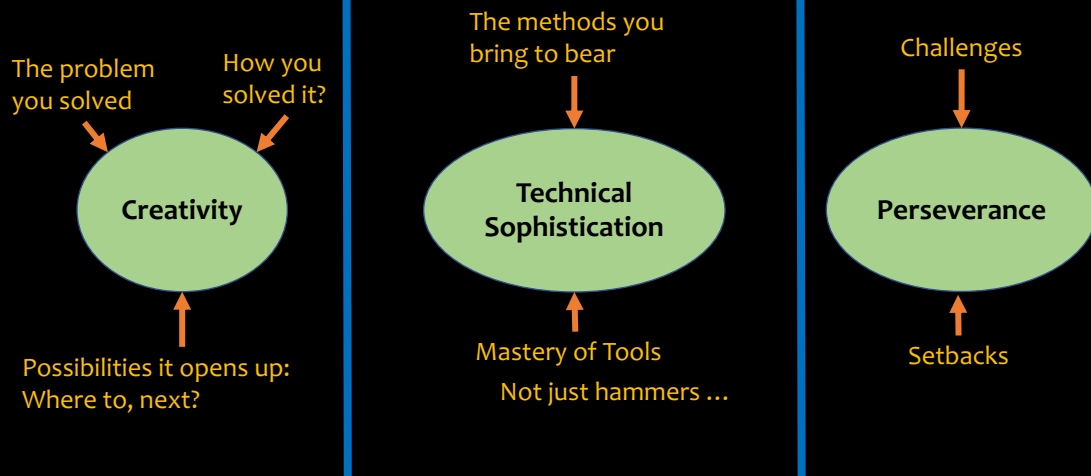
Term Projects

You have a lot of freedom and a lot of power

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Why term projects matter – Part I



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Why term projects matter – Part II

- **Transferrable skills**
 - Skills you hone, can be brought to bear on other problems
 - Gift that keeps on giving
- **Interviews**
 - Keeps the conversation going
 - Who can make the most persuasive argument for you?
 - Someone else!
 - You are providing ammo for those who are championing your case

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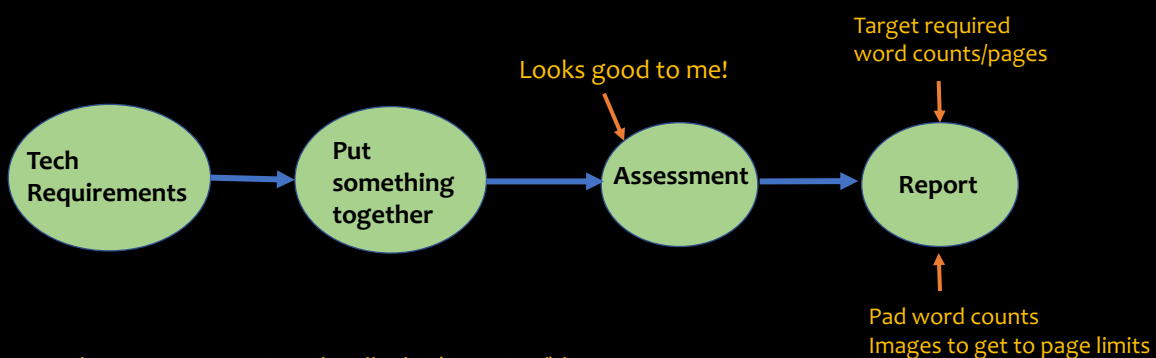
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But term projects end up ...

- With the **lowest priority** and are subject to **procrastinations**
- Being an exercise in passing the buck
 - Easier to assign blame than to shoulder responsibilities
- With the team never really coming together
 - Either you are working with
 - Your friends who are loathe to provide critical feedback
 - Folks who you don't know, and so you don't interact with at any meaningful level

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The Current Journey for Term Projects



Tasks are not apportioned well. The (*perceived*) best parts are worked on by the **lead**, scraps for the others.

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You can't use up creativity. The more you use, the more you have.
Maya Angelou

How to get there ...

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What is a term project?

- Fundamentally, involves **story-telling**
 - Something that has not been told before
 - Guided in many ways by your own unique experiences
- It's not just about what you have done, but in *equal parts*, also about **how you think?**
- Involves some constraints
 - There may be required hardware or software elements

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Every good story in the sciences
begins with ...**a question**

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Why asking the right question matters ...

- Forestalls fishing expeditions
- Guides you (it's your North Star)
 - Team is looking in the same direction
 - Use it to inform micro-corrections
- Allows you to explore, compare, and contrast different approaches to the problem

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Are you asking the right question?

- Any random question is not a good question
- Should be grounded (to some extent) in reality
 - Your expertise, experiences, etc.

**Don't go off
Into the dark!**



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Some examples of questions ...

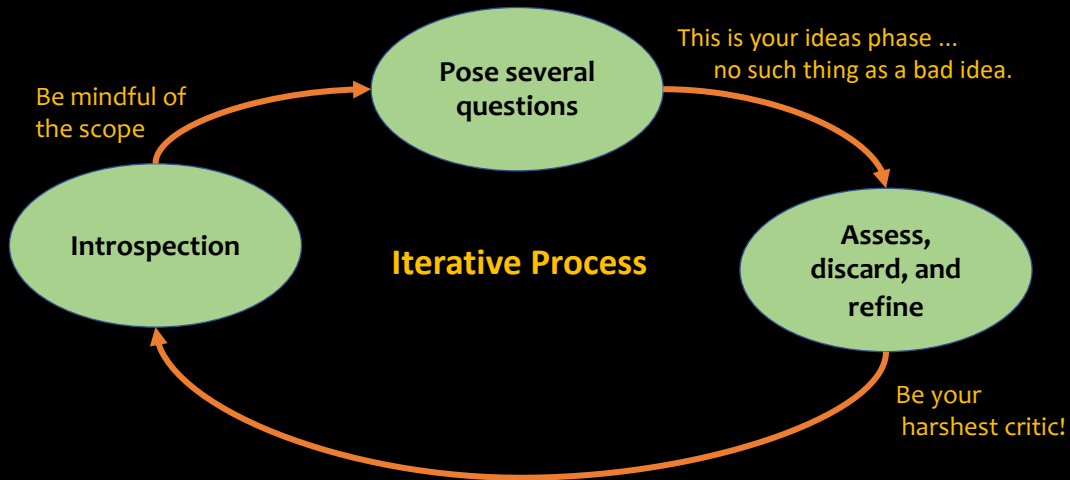
- Why is the pine beetle population exploding?
- Given my budget, where can I travel to soon and for *how long*?
- From a crime perspective, which streets should be avoided?
 - Depending on the time of day/week/season/event
- Examples from my research
 - VitalHome
 - Sketching algorithms

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How do you ask the right question ...



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There will always be something lacking

- Desired number of resources (CPUs, GPUs, etc.) may be unavailable
- Data may be unsatisfactory
 - Not the right size, format, etc.
- Solution: Work at a smaller scale
 - Testing is often more exhaustive and productive on a smaller set of machines
 - Working with a smaller dataset (or a synthetic one that you created) helps you understand the data space better

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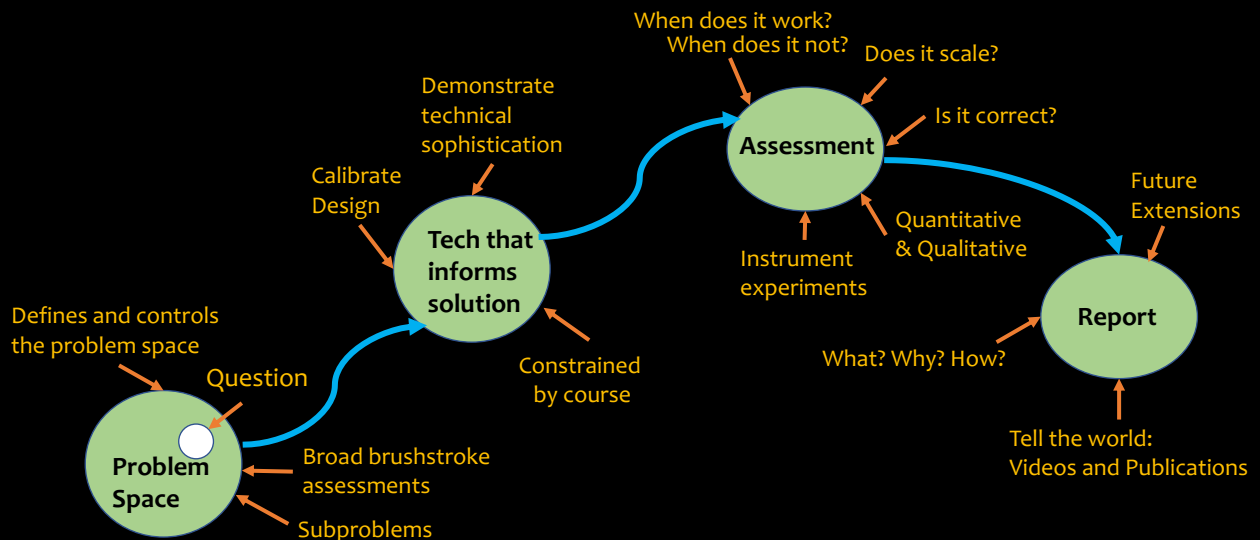
How do you demonstrate technical sophistication?

- By leveraging the right tools for the task *and* using them correctly
- Technical sophistication = Elegance
- Assessing how well the goals are achieved
 - Quantitative and/or qualitative

“Everything should be made as simple as possible, but no simpler.”
Albert Einstein

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The Journey I Hope You Will Take ...



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Projects are not a straight line from start to finish

- Iterative process that involves detours
- Detours are what makes a story interesting
 - What did not work and why
 - Informs *why* you did what you did
- Side effect
 - A holistic understanding of the problem space

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Other things that will help you get there

- Set up longer brainstorming sessions
- Meet early and often; and engage all team members
 - Zoom, Slack, GitHub, etc
- Every team member works on every phase of the project
 - Ideas, methodology formulation, implementation, report writing

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Why we are having in-class project pitches

- Help with refining questions (micro-calibration, if needed)
- You can learn from how other projects are being formulated

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You start a conversation, you can't even finish it
You're talking a lot, but you're not saying anything
When I have nothing to say, my lips are sealed
Say something once, why say it again?

Psycho Killer, Talking Heads

The writing component

Term project report

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Writing

- Take the reader on a journey
 - Watch for the flow
 - Curate what you choose to say and what not to
 - The rationale, key methodological aspects, justifications, and performance discussion should all be there
- Make it interesting
 - Always emphasize why some aspect is salient
 - Don't leave it to the reader to figure this out somehow
- Ensure that the takeaways come through
 - These are points you reinforce multiple times

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Questions?

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