CMPT 479/745
Software Engineering: Theory and Practice

Introduction

Nick Sumner
wsumner@sfu.ca

CMPT 479/745

Software Engineering: Theory and Practice

Introduction

Nick Sumner
wsumner@sfu.ca

CMPT 479/**745**
Software Engineering: Theory and Practice

Introduction

Nick Sumner
wsumner@sfu.ca

Introduction

- Who am I?
  - Nick Sumner (wsumner@sfu.ca)
  - Research Faculty (Software Engineering, Compilers, Program Analysis)

Introduction

- Who am I?
  - Nick Sumner (wsumner@sfu.ca)
  - Research Faculty
- Who is your TA?
  - Nazanin Yousefian

Introduction

- Who am I?
  - Nick Sumner (wsumner@sfu.ca)
  - Research Faculty
- Who is your TA?
  - Nazanin Yousefian
- What is the course website?
  - http://www.cs.sfu.ca/~wsumner/teaching/745/

Introduction

- Who am I?
  - Nick Sumner (wsumner@sfu.ca)
  - Research Faculty
- Who is your TA?
  - Nazanin Yousefian
- What is the course website?
  - http://www.cs.sfu.ca/~wsumner/teaching/745/
- Where can you discuss course issues?
  - CourSys
    https://coursys.sfu.ca/2024sp-cmpt-982-x1/forum/

What is this class?

- Software engineering (informally)
  - Systematic approaches for managing risk while producing or providing software.

What is this class?

- Software engineering (informally)
  - Systematic approaches for managing risk while producing or providing software.
  - How can we write code that is adaptable to changing requirements?

What is this class?

- Software engineering (informally)
  - Systematic approaches for managing risk while producing or providing software.
  - How can we write code that is adaptable to changing requirements?
  - How can you know that code is correct or discover its incorrectness?

What is this class?

- Software engineering (informally)
  - Systematic approaches for managing risk while producing or providing software.

  - How can we write code that is adaptable to changing requirements?
  - How can you know that code is correct or discover its incorrectness?
  - Can you defend against attackers?

What is this class?

- Software engineering (informally)
  - Systematic approaches for managing risk while producing or providing software.

  - How can we write code that is adaptable to changing requirements?
  - How can you know that code is correct or discover its incorrectness?
  - Can you defend against attackers?
  - Can you discover what attackers have done?

What is this class?

- Software engineering (informally)
  - Systematic approaches for managing risk while producing or providing software.

  - How can we write code that is adaptable to changing requirements?
  - How can you know that code is correct or discover its incorrectness?
  - Can you defend against attackers?
  - Can you discover what attackers have done?
  - Can you automatically generate software?

What is this class?

- Software engineering (informally)
  - Systematic approaches for managing risk while producing or providing software.

  - How can we write code that is adaptable to changing requirements?
  - How can you know that code is correct or discover its incorrectness?
  - Can you defend against attackers?
  - Can you discover what attackers have done?
  - Can you automatically generate software?

Programs are themselves data that you can construct, analyze, transform, synthesize, …

What is this class?

- Software engineering (informally)
  - Systematic approaches for managing risk while producing or providing software.

  - How can we write code that is adaptable to changing requirements?
  - How can you know that code is correct or discover its incorrectness?
  - Can you defend against attackers?
  - Can you discover what attackers have done?
  - Can you automatically generate software?

  - Spans techniques from novel logics to rigorous empirical assessment.
  - Rich *interaction* between theory and practice matter.

What is this class?

- Software engineering (informally)
  - Systematic approaches for managing risk while producing or providing software.
  - How can we write code that is adaptable to changing requirements?
  - How can we write code that is adaptable to changing requirements?
  - Can you
  - Can you
  - Can you

I will expect you to

  - Spans techniques from novel logics to rigorous empirical assessment.
  - Rich *interaction* between theory and practice matter.

What is this class?

- Software engineering (informally)
  - Systematic approaches for managing risk while producing or providing software.
  - How can we write code that is adaptable to changing requirements?
  - How can we write code that is adaptable to changing requirements?
  - Can you
  - Can you
  - Can you

I will expect you to reason formally.

  - Spans techniques from novel logics to rigorous empirical assessment.
  - Rich *interaction* between theory and practice matter.

What is this class?

- Software engineering (informally)
  - Systematic approaches for managing risk while producing or providing software.

  - How can we write code that is adaptable to changing requirements?
  - How can we ensure correctness?
  - Can you
  - Can you
  - Can you

  - Spans techniques from novel logics to rigorous empirical assessment.
  - Rich *interaction* between theory and practice matter.

I will expect you to
reason formally.
reason practically.

What is this class?

- Software engineering (informally)
  - Systematic approaches for managing risk while producing or providing software.
  - How can we write code that is adaptable to changing requirements?
  - How can we ensure correctness?
  - Can you
  - Can you
  - Can you

I will expect you to
- reason formally.
- reason practically.
- *apply* formalism to *solve practical problems*.

  - Spans techniques from novel logics to rigorous empirical assessment.
  - Rich *interaction* between theory and practice matter.

What is this class?

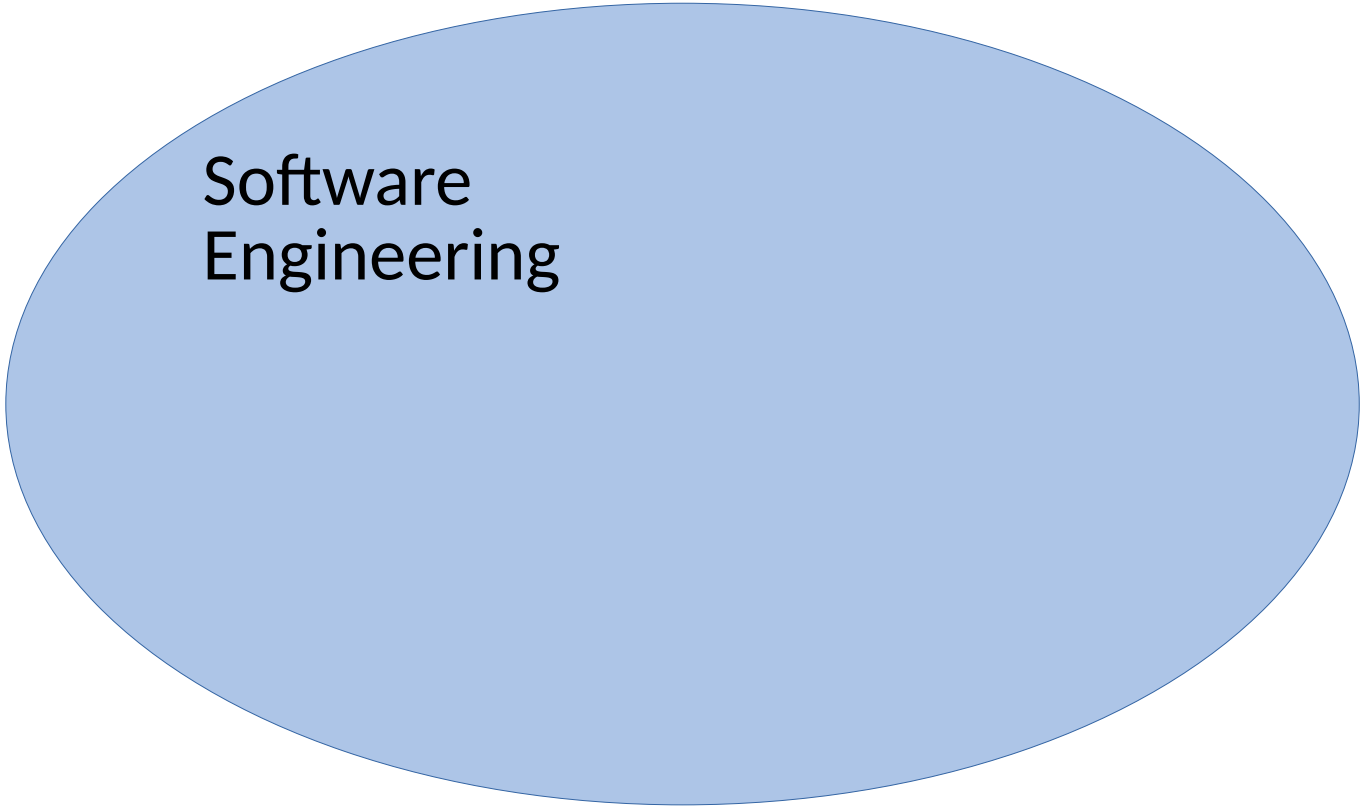
- Software engineering (informally)
  - Systematic approaches for managing risk while producing or providing software.

  - How can we write code that is adaptable to changing requirements?
  - How can we write code that is adaptable to changing requirements?
  - Can you
  - Can you
  - Can you

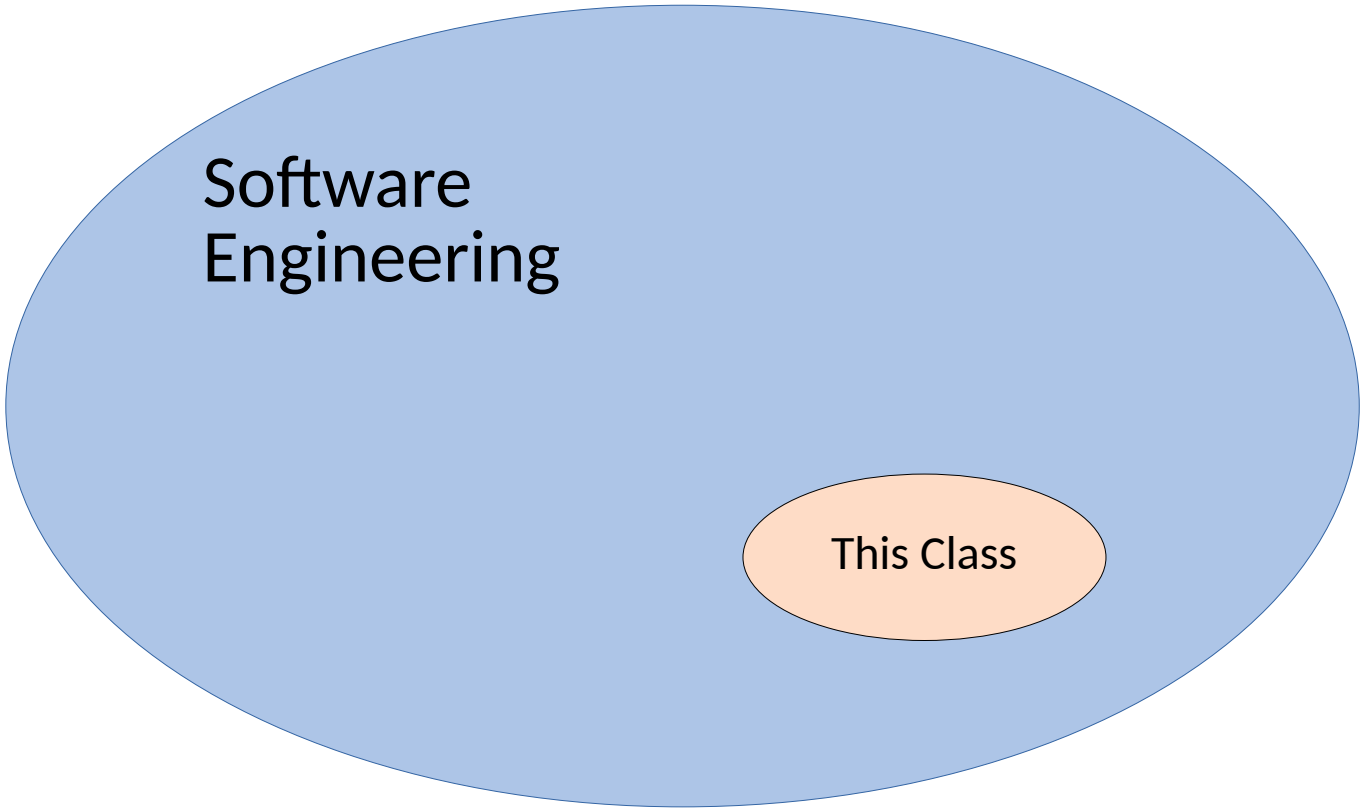
I will expect you to
- reason formally.
- reason practically.
- *apply* formalism to *solve practical problems*.
- recognize that practice may differ from formalism.

  - Spans techniques from novel logics to rigorous empirical assessment.
  - Rich *interaction* between theory and practice matter.

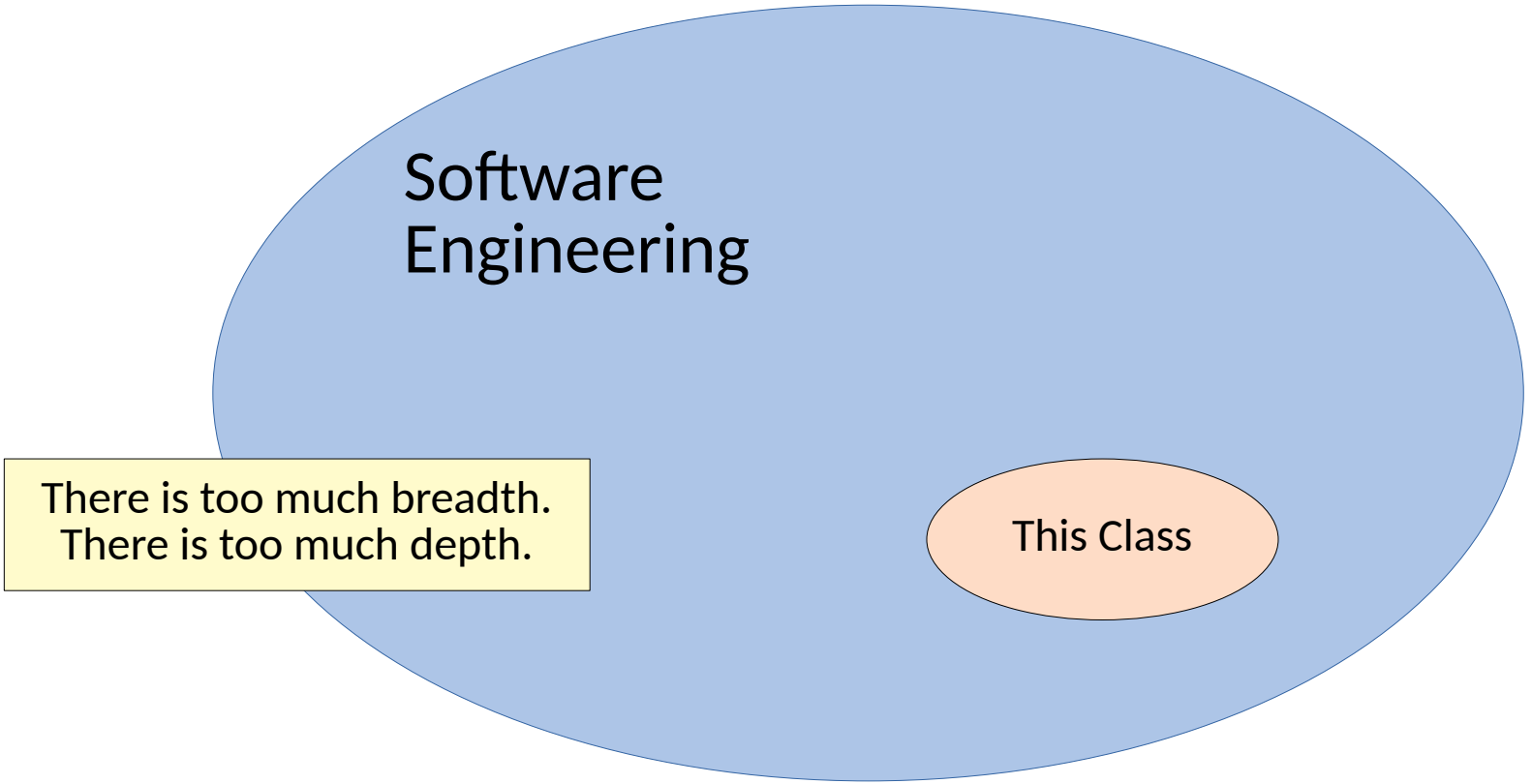
What is this class?



What is this class?



What is this class?



What is this class?

- Important things we will ***not*** cover (nonexhaustive)

What is this class?

- Important things we will ***not*** cover (nonexhaustive)
  - Social aspects of software engineering
  - Project planning and management (Agile vs agile vs …)
  - Requirements management
  - SLOs, SLA, and most SRE
  - Monoliths vs Services vs Microservices
  - Middleware management
  - …

What is this class?

- Important things we will ***not*** cover (nonexhaustive)
  - Social aspects of software engineering
  - Project planning and management (Agile vs agile vs …)
  - Requirements management
  - SLOs, SLA, and most SRE
  - Monoliths vs Services vs Microservices
  - Middleware management
  - …

These are worthwhile topics.
Seek them elsewhere.

What is this class?

- What we will (likely) cover
  - Foundations of software design
  - Performance & bottleneck analysis
  - Testing
  - Formal models of programs
  - Symbolic execution and automated test generation
  - Dynamic analysis
  - Static analysis
  - Parallelism & concurrency
  - Software security
  - Program synthesis

What is this class?

- What we will (likely) cover
  - **Foundations of software design**
  - **Performance & bottleneck analysis**
  - **Testing**
  - Formal models of programs
  - Symbolic execution and automated test generation
  - Dynamic analysis
  - Static analysis
  - Parallelism & concurrency
  - Software security
  - Program synthesis

What is this class?

- What we will (likely) cover
  - Foundations of software design
  - Performance & bottleneck analysis
  - Testing
  - **Formal models of programs**
  - Symbolic execution and automated test generation
  - Dynamic analysis
  - Static analysis
  - Parallelism & concurrency
  - Software security
  - Program synthesis

What is this class?

- What we will (likely) cover
  - Foundations of software design
  - Performance & bottleneck analysis
  - Testing
  - Formal models of programs
  - **Symbolic execution and automated test generation**
  - **Dynamic analysis**
  - **Static analysis**
  - Parallelism & concurrency
  - Software security
  - Program synthesis

What is this class?

- What we will (likely) cover
  - Foundations of software design
  - Performance & bottleneck analysis
  - Testing
  - Formal models of programs
  - Symbolic execution and automated test generation
  - Dynamic analysis
  - Static analysis
  - **Parallelism & concurrency**
  - **Software security**
  - **Program synthesis**

What is this class?

- What we will (likely) cover
  - Foundations of software design
  - Performance & bottleneck analysis
  - Testing
  - Formal models of programs
  - Symbolic execution and automated test generation
  - Dynamic analysis
  - Static analysis
  - Parallelism & concurrency
  - Software security
  - Program synthesis

What is this class?

- What we will (likely) cover
  - Foundations of software design
  - Performance & bottleneck analysis
  - Testing
  - Formal models of programs
  - Symbolic execution and automated test generation
  - Dynamic analysis
  - Static analysis
  - Parallelism & concurrency
  - Software security
  - Program synthesis
- https://www2.cs.sfu.ca/~wsumner/teaching/745/24/schedule.html

What is this class?

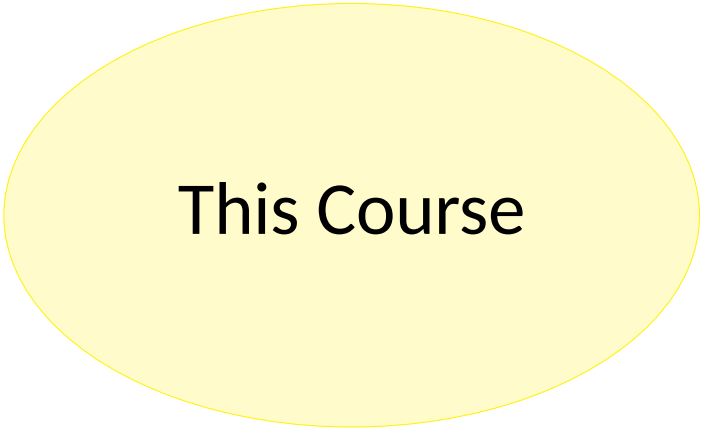
- What we will (likely) cover
  - Foundations of software design
  - Performance & bottleneck analysis
  - Testing
  - Formal models of programs
  - Symbolic execution and automated test generation
  - Dynamic analysis
  - Static analysis
  - Parallelism & concurrency
  - Software security
  - Program synthesis

There is still far too much!
We will focus on *breadth* over *depth*.

- https://www2.cs.sfu.ca/~wsumner/teaching/745/24/schedule.html

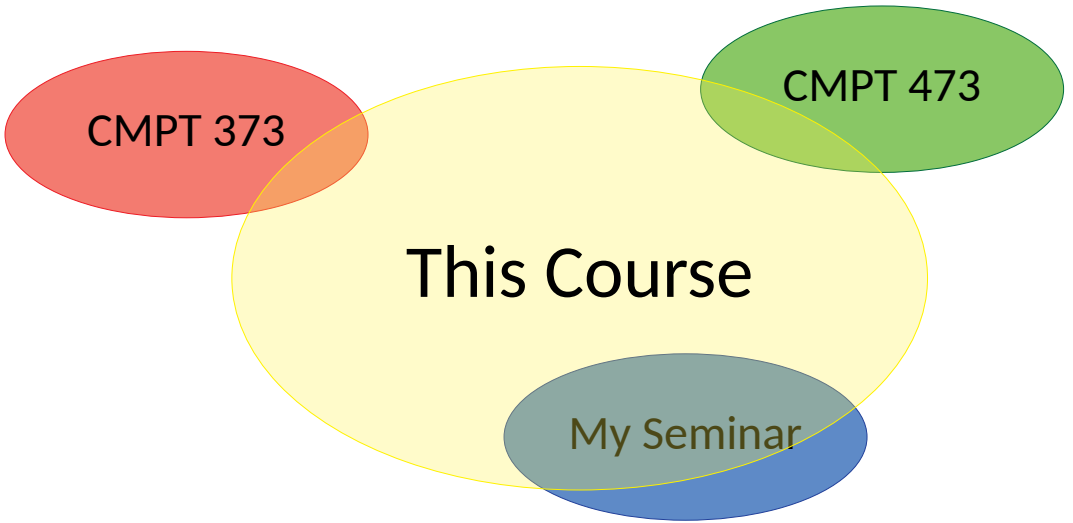
What is this class?

- What we will (likely) cover



What is this class?

- What we will (likely) cover



How will the class be structured?

- Grading:
  - Exercises (weekly): 50%
  - Exams: 25%
  - Term Project: 25%

How will the class be structured?

- Grading:
  - Exercises (weekly): 50%
  - Exams: 25%
  - Term Project: 25%
- Exercises
  - A short(ish) programming and/or written assignment each week
  - Demonstrate understanding & application of in class material
  - Will expect you to think critically & independently

How will the class be structured?

- Grading:
  - Exercises (weekly): 50%
  - Exams: 25%
  - Term Project: 25%
- Exercises
  - A short(ish) programming and/or written assignment each week
  - Demonstrate understanding & application of in class material
  - Will expect you to think critically & independently

Will make use of at least
C++, Java, and Python

How will the class be structured?

- Grading:
  - Exercises (weekly): 50%
  - Exams: 25%
  - Term Project: 25%
- Exercises
  - A short(ish) programming and/or written assignment each week
  - Demonstrate understanding & application of in class material
  - Will expect you to think critically & independently

How will the class be structured?

- Grading:
  - Exercises (weekly): 50%
  - Exams: 25%
  - Term Project: 25%
- Exercises
  - A short(ish) programming and/or written assignment each week
  - Demonstrate understanding & application of in class material
  - Will expect you to think critically & independently
- Exams
  - Just the final
  - Demonstrate competence & application of course material

How will the class be structured?

- Term Projects:
  - An open ended project that demonstrates competence

How will the class be structured?

- Term Projects:
  - An open ended project that demonstrates competence
  - Address real world problems in software engineering

How will the class be structured?

- Term Projects:
  - An open ended project that demonstrates competence
  - Address real world problems in software engineering
  - Develop a new tool or technique to address the problem

How will the class be structured?

- Term Projects:
  - An open ended project that demonstrates competence
  - Address real world problems in software engineering
  - Develop a new tool or technique to address the problem

  - For undergrads, I have preplanned projects if you want them
  - Grads should come up with a proposal of their own

How will the class be structured?

- Term Projects:
  - An open ended project that demonstrates competence
  - Address real world problems in software engineering
  - Develop a new tool or technique to address the problem

  - For undergrads, I have preplanned projects if you want them
  - Grads should come up with a proposal of their own
  - Discussing with me in advance is recommended
  - Initial proposals due by Feb 13th. Meetings w/me on ~14th - 16th.

How will the class be structured?

- Term Projects:
  - An open ended project that demonstrates competence
  - Address real world problems in software engineering
  - Develop a new tool or technique to address the problem

  - For undergrads, I have preplanned projects if you want them
  - Grads should come up with a proposal of their own
  - Discussing with me in advance is recommended
  - Initial proposals due by Feb 13th. Meetings w/me on ~14th - 16th.

I want you to walk away with a project you are proud of.
It may lead to a paper.
It may to a business.
It may lead to a tool.

Policies & Expectations

- Late Submissions
  - None accepted in general (3 late days to spend throughout semester)

Policies & Expectations

- Late Submissions
  - None accepted in general (3 late days to spend throughout semester)
- Cheating
  - Any instance results in a score of 0 for the entire assignment involved.
  - Repeat offenders will be reported and recommended for immediate failure in the course.

Policies & Expectations

- Late Submissions
  - None accepted in general (3 late days to spend throughout semester)
- Cheating
  - Any instance results in a score of 0 for the entire assignment involved.
  - Repeat offenders will be reported and recommended for immediate failure in the course.

It is better to get 0 credit than to cheat!

Policies & Expectations

- Late Submissions
  - None accepted in general (3 late days to spend throughout semester)
- Cheating
  - Any instance results in a score of 0 for the entire assignment involved.
  - Repeat offenders will be reported and recommended for immediate failure in the course.
  - Per SFU policy, sharing your solution to an assignment is dishonesty.
    Do not post solutions for assignments to github or elsewhere.

Policies & Expectations

- Late Submissions
  - None accepted in general (3 late days to spend throughout semester)
- Cheating
  - Any instance results in a score of 0 for the entire assignment involved.
  - Repeat offenders will be reported and recommended for immediate failure in the course.
- Expected Workload
  - Strong should expect to spend 9-10 hours outside of class per week.
  - If you are missing some skills, you should expect to spend more.
  - This is not a required class.
    If you are only here for credit, it is better to leave.

Policies & Expectations

- Late Submissions
  - None accepted in general (3 late days to spend throughout semester)
- Cheating
  - Any instance results in a score of 0 for the entire assignment involved.
  - Repeat offenders will be reported and recommended for immediate failure in the course.
- Expected Workload
  - Strong should expect to spend 9-10 hours outside of class per week.
  - If you are missing some skills, you should expect to spend more.
  - This is not a required class.
    If you are only here for credit, it is better to leave.
- Attendance
  - You don't have to attend, but all in class materials are your responsibility

Let’s get started