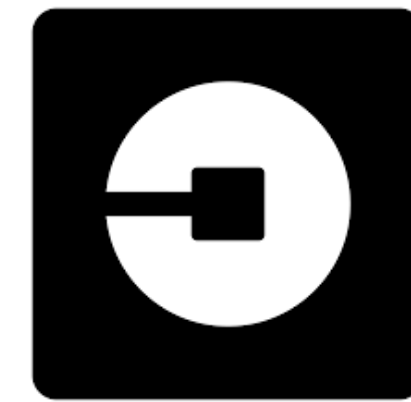# CS4740
CLOUD COMPUTING

Course Introduction

Prof. Chang Lou, UVA CS, Fall 2025

AGENDA

— **What this course is about**

— what to expect from this course

— **How to get the most from this course**

— .. and what we expect from you

— **But first, tell us about yourself**

— who you are, and why you chose this course

WHY STUDY CLOUD COMPUTING

— **Cloud services are the foundation for modern society.**
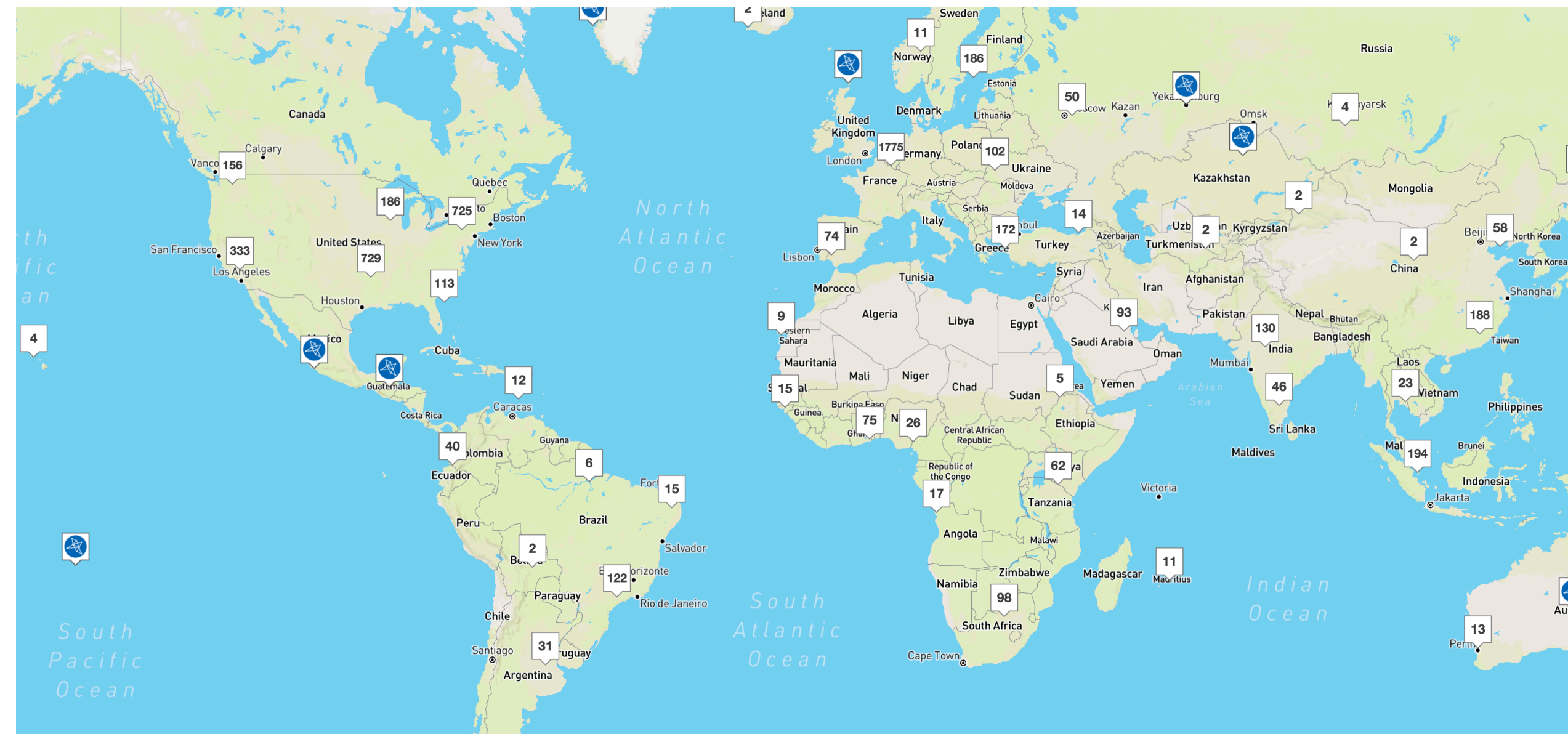
WHY STUDY CLOUD COMPUTING

— A day without cloud?

In 2025, 96% of enterprises use cloud services!

WHY STUDY CLOUD COMPUTING

— **Rising needs for cloud computing**

— Today: cloud market is $676B (expected to reach $2.2T by 2032)

— There is a high demand for talents on the market

AMAZON HQ2 IN ARLINGTON, VIRGINIA

WHY STUDY CLOUD COMPUTING

— Cloud systems are fun (and hard :))

— tons of interesting problems

How to scale systems to handle requests from millions of users?
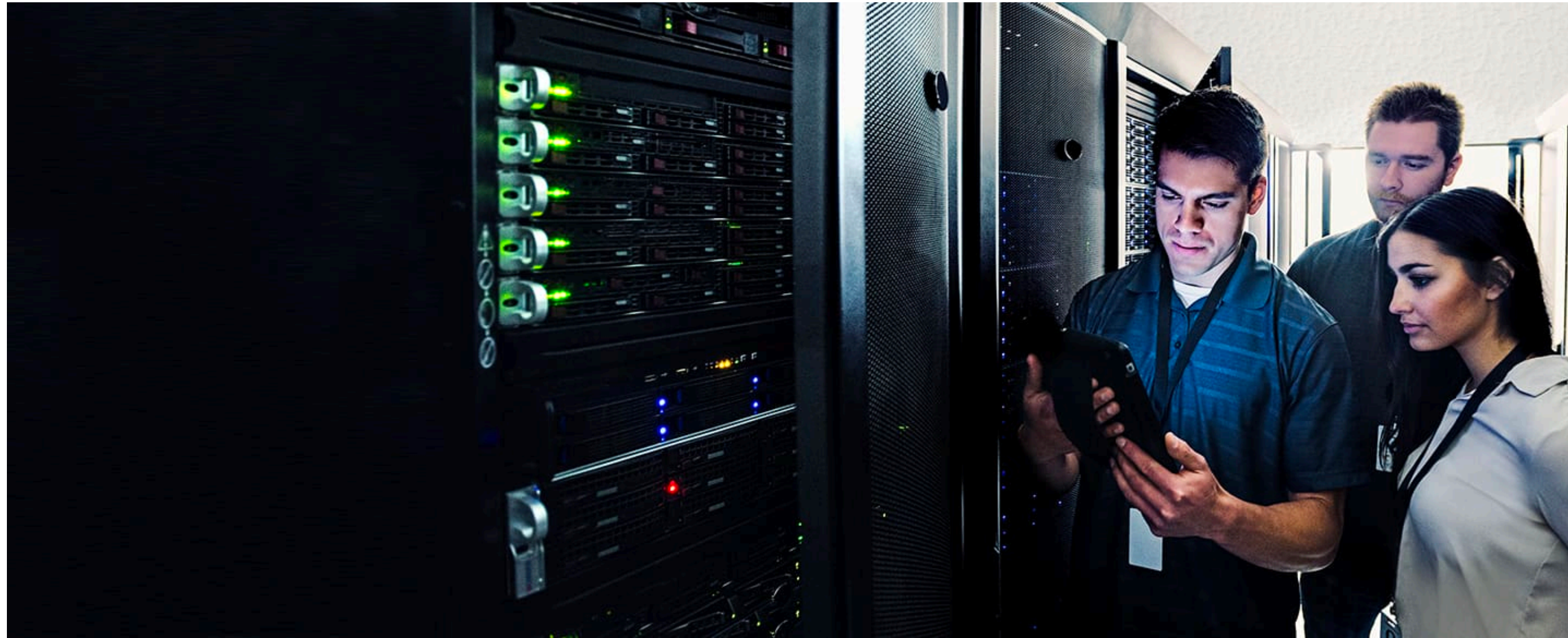
How to keep systems running despite constant failures?

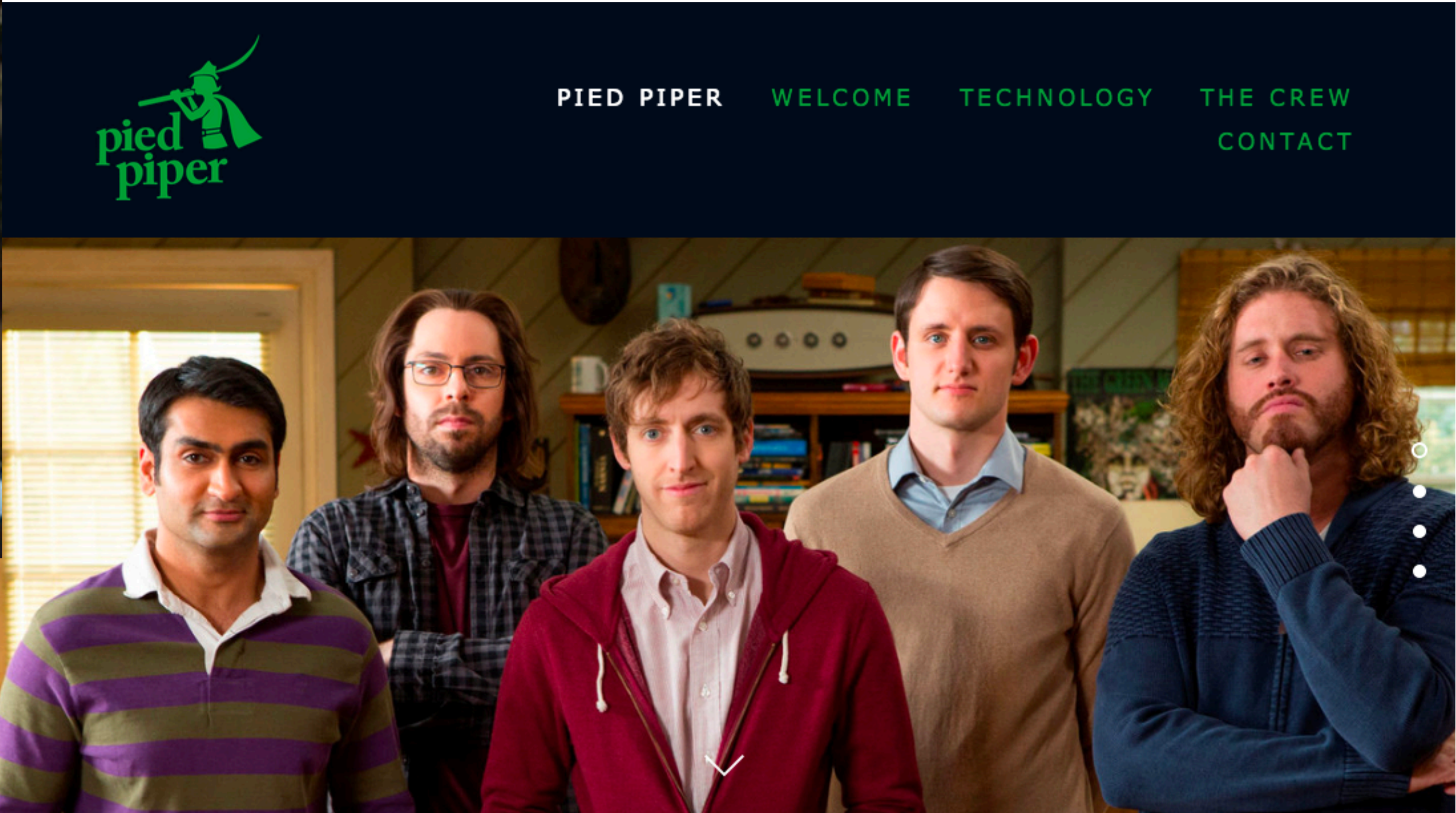How to make thousands of servers behave like one single machine?

...

WHAT WE FOCUS IN THIS COURSE

— Learn AWS toolkit?

— Design cloud apps?

— Important to know how to use cloud services

— many related courses provided in UVA

— **In this course we focus on how to build cloud systems**

WHAT WE FOCUS IN THIS COURSE

WHAT WE FOCUS IN THIS COURSE

TOPICS (TENTATIVE)

Week	Mon	Wed	Fri
1	—	8 / 27 Orientation & Syllabus	8 / 29 Cloud Intro I
2	9 / 1 Cloud Intro II	9 / 3 Dist-Sys Foundations I	9 / 5 Dist-Sys Foundations II ★
3	9 / 8 MapReduce I	9 / 10 MapReduce II	9 / 12 RPC I
4	9 / 15 RPC II	9 / 17 Transactions I	9 / 19 Transactions II
5	9 / 22 Transactions III	9 / 24 Time & Coordination I	9 / 26 *Hacker Day* ★
6	9 / 29 Time & Coordination II	10 / 1 Agreement	10 / 3 Two-Phase Commit I
7	10 / 6 Two-Phase Commit II	10 / 8 Consensus I	10 / 10 Consensus II
8	*10 / 13 Reading Day*	10 / 15 Consensus III	10 / 17 Isolation & Consistency I
9	10 / 20 *Hacker Day* ★	10 / 22 Isolation & Consistency II	10 / 24 Case Study: GFS
10	10 / 27 Case Study: ZooKeeper I	10 / 29 ZooKeeper II	10 / 31 Lab Day • Play w/ ZK I
11	11 / 3 Lab Day • Play w/ ZK II	11 / 5 Guest Talk	11 / 7 Lab Day • Hack ZK I
12	11 / 10 Lab Day • Hack ZK II	11 / 12 Guest Talk	11 / 14 Virtualization
13	11 / 17 MLSys I ★	11 / 19 MLSys II	11 / 21 Cloud Infra
14	11 / 24 *Hacker Day*	*11 / 26 Thanksgiving Recess*	*11 / 28 Thanksgiving Recess*
15	12 / 1 Reliability I	12 / 3 Reliability II	12 / 5 Final Review
16	12 / 8 Extra Q&A ★	—	—

WHAT WE COVER IN THIS COURSE

— Foundational concepts of cloud systems: **distributed systems**

— challenges, algorithms, techniques, abstractions.

— The inner-workings of large **cloud infrastructure**.

— E.g., Google's protobuf/Spanner/MapReduce, Yahoo's Hadoop, Amazon's Dynamo, etc.

— Building small cloud systems yourself.

— a MapReduce system that scales computing workloads

— a Raft-based system that tolerates failures on any single node

Course Information

LECTURER INFO

— **Prof. Chang Lou**

— Ph.D., Johns Hopkins

— Experience with Cloud Infrastructure in Production

— **Research Interests**

— Cloud/Distributed Systems, Software Reliability

— **Contact**

— Office: Rice Hall 304

— Office Hours: Tuesday 4-5pm, Thursday 3-4pm

TEACHING STAFF

— TAs

— Dimas Parikesit (vqx2dc@virginia.edu), office hour: Wednesday 5-6pm, Rice 442

— Zhenyu Li (vnr3ne@virginia.edu), office hour: Friday 3-4pm, Rice 442

— Yunfan Wang (abe6fq@virginia.edu), office hour: Monday 2–3 pm, Rice 442

— **cs4740staff@virginia.edu** (preferred email channel for the course staff)

IMPORTANT LINKS

— Website: https://changlousys.github.io/CS4740/fall25/about/

— Questions && Discussions:

  — Lecture related questions: Piazza, Lecturer office hours

  — Lab related questions: Piazza, TA office hours

— Important links (available on course website, including this slide):

  — Piazza: https://piazza.com/virginia/fall2025/cs4740

  — Canvas: https://canvas.its.virginia.edu/courses/147308

GRADING

— Midterm exam: 20% + 10% (project question)

— Final exam: 20% + 10% (project question)

— Projects: 40%

   — Two labs: based on MIT's 6.584 series

   — Assignments are written in Go

   — Use Github Classroom to create your repo

LAB (GITHUB CLASSROOM)

— Invitation link: https://classroom.github.com/a/N9sAehDv

LAB (GITHUB CLASSROOM)

— We automatically collect
your codes by taking a
snapshot of your repo
before deadline (unless
late tokens are used)

— all you need is to push
your local commits
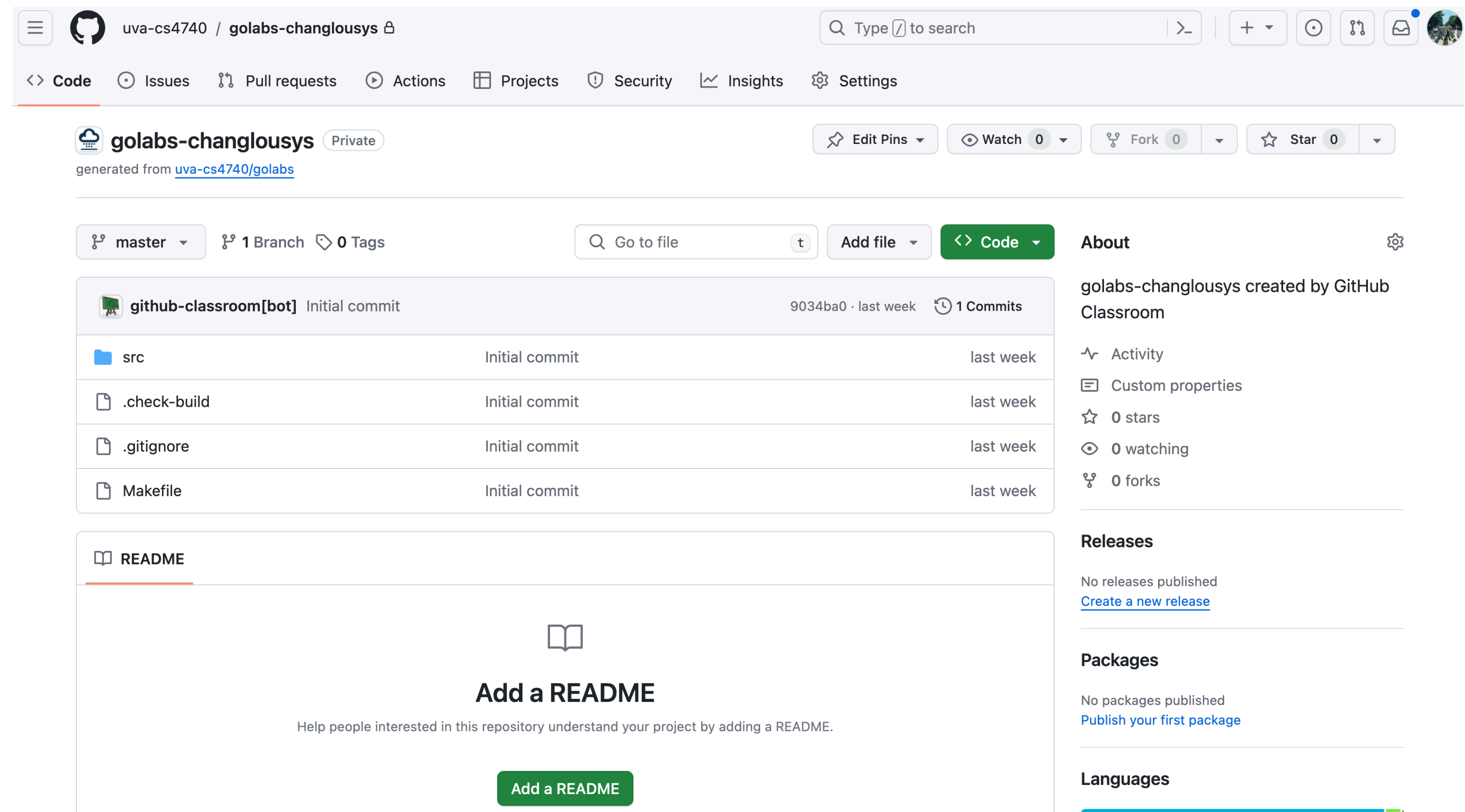
PREREQUISITES

— **Solid programming experience** (C, C++, Java), preferably system-level programming experience.

  — Do you enjoy debugging? :)

— UVA courses:

  — CS 2130 (Computer Systems and Organization)

— If you lack these prerequisites, taking this class will be very difficult, because heavy **coding** accounts for vast portion of grade.

  — Use Lab 0 to determine if you have sufficient experience.

LATE POLICIES

— What if I have emergencies?

— Everyone has 72 hour late tokens on projects

  — If you decide to use the late hour tokens, by the deadline send an email to cs4740staff@virginia.edu with the subject "[Late Request]: $GitHub_Repo_Name$" (empty content is fine) so we won't be collecting and grading your solution immediately.

  — When you finish (within the token limit), send another email to cs4740staff@virginia.edu with the subject "[Late Finish]: $GitHub_Repo_Name$".

CHEATING POLICIES

— You can discuss, preferably openly on Piazza, but NOT look at or copy someone else's code!

 — "Someone else's code" could be: from a present colleague, from a past student (at UVA or somewhere else), from the Internet.

 — We will be checking all code for cheating and optionally do oral examinations.

CHATGPT POLICY

—**How to best use AI tools**

   — understand error messages

   — brainstorm design/debugging tips

—**You should not use AI to**

   — directly generate codes for you

It is a violation of academic integrity as well.
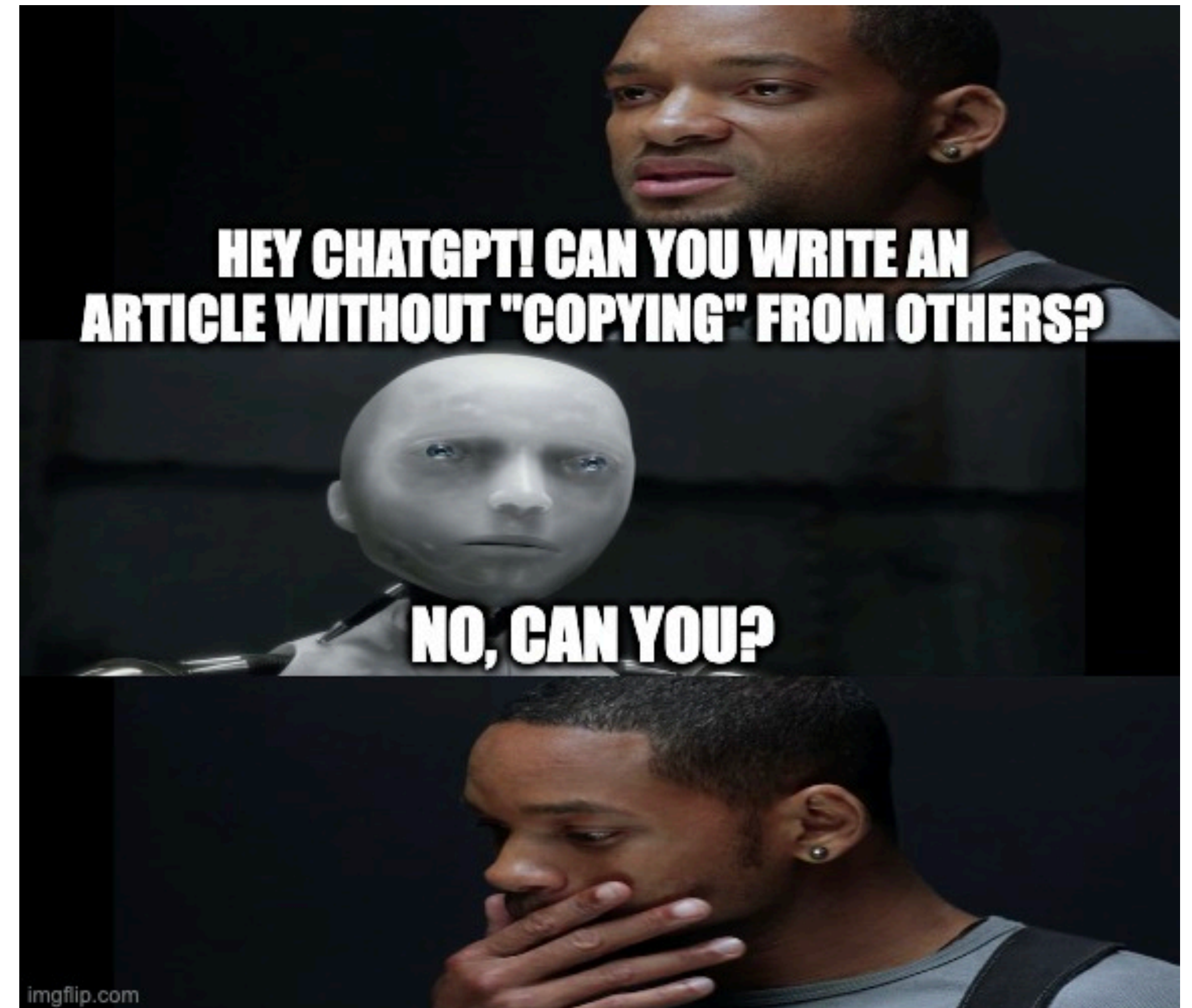
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LAB 0

– Not graded but mandatory and important:

– Sets up github, which you'll use for all homeworks.

– Complete this homework even if you are not yet enrolled (but you hope to be)!

– Test if you like the style of this course :)

– Deadline: 9/8/2025 23:59:59 EST

– Please finish it as soon as possible to weed out any issues so you can start on Lab 1 on time.

HOW NOT TO PASS CS 4740?

— Do not come to lecture

- The slides and labs are online anyway

- Lecture walks you through difficult materials and tells you the context

— Do not ask questions in lecture, office hours or online

- It's scary, I don't want to embarrass myself

- Asking questions is the best way to clarify lecture material

- Office hours and email will help with homework, projects

HOW NOT TO PASS CS 4740?

— Wait until the last couple of days to start a project

- We'll have to do the crunch anyways, why do it early?

- The projects cannot be done in the last few days

- **Repeat**: The projects cannot be done in the last few days

- (p.s. The projects cannot be done in the last few days)

Questions?

NEXT STEPS

– Start working on **Lab 0** today!

   – If you run into issues, TAs and I will be happy to help

– Next class: Introduction to cloud

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ACKNOWLEDGEMENT