CS138: Distributed Systems

Course Information and Syllabus

Semester II, 2018–2019

Lectures	I hour 20 min: 10:30–11:50 on Tuesdays and Thursdays
Room	CIT 368
Lecture Notes	http://www.cs.brown.edu/courses/cs138/s19/syllabus.html A recording of each lecture will be available soon after it is given.
Text	*Distributed Systems: Concept and Design*, by Colouris, Dollimore, Kindberg, Blair, 2011
Prerequisite	CS 33 or CS32
Instructor	Theophilus Benson (tab@cs.brown.edu)
Office	CIT 327
Office Hours	***Tuesdays 4-5 and Wednesdays 11-12, or by appointment***
Head TAs	Joshua Pattiz (jpattiz@cs.brown.edu) Martin Ma(zma17@cs.brown.edu)
UTAs	Ali Mar (am209@cs.brown.edu) Brian Oppenheim (boppenhe@cs.brown.edu) Galadriel Brady (gbrady1@cs.brown.edu) Kerem Gurbey (kerem_gurbey@brown.edu) Kristen McLean (kmclean1@cs.brown.edu) Tina Lu (yuyang_Lu@brown.edu) William Riley (wriley1@cs.brown.edu) Zhedi Zhang (zzhang57@cs.brown.edu)
Requirements	4 Programs (50%) (additionally there is an optional program at the beginning of the course; it will not count towards the course grade) 4 Homeworks (20%) Midterm Exam (10%) Final Exam (20%)
Time Requirements	In addition to three hours per week in class, you will spend 10 to 20 hours per week on homeworks and programs.
Goals	We will teach you the theoretical underpinnings of distributed systems and will teach you to write programs that run on multiple, geographically dispersed computers and that are tolerant of many sorts of faults. You will do problem sets based on the lectures that will help you grasp and apply the theoretical material. You will do a sequence

	of programming projects, working in groups of two that not only apply what's covered in lectures, but give you experience in coding and debugging distributed systems. We have you write the programs in a language that's probably new to you, Go, chosen because it allows you to focus on the distributed aspects of a system without getting bogged down in other details.
All Are Welcome	Our intent is that this course provide a welcoming environment for all students who satisfy the prerequisites. Our TAs have undergone training in diversity and inclusion; all members of the CS community, including faculty and staff, are expected to treat one another in a professional manner. If you feel you have been treated unprofessionally by any of the course staff, please contact Prof. Benson (the instructors), Prof. Cetintemel (the department chair), or Laura Dobler (the department's coordinator for diversity and inclusion initiatives). We take all complaints about unprofessional behavior seriously
Grading	Homeworks, exams, and programs are given numerical grades; "curving" is done on a per-assignment basis. The final course grade is the weighted average of the ``curved'' homework, exam, and program grades. The first program is 10% of your course grade; each of the others is 13.33% The midterm exam is 10% of your course grade; the final exam is 20%. Each homework is 5% of your course grade. Please note that your assignments will be graded by the TAs, most of whom are undergraduates. If you have a question about the grading of an assignment, please bring it up first with the TA who graded it. If your question is not resolved to your satisfaction, then bring it up with Prof. Benson. **Regrades**: Regrades can be requested at most one week after the return of grades. The exceptions are the final – for these you will 24hours. During regrades, you may **get points back or lose points -- regrades may result in grades going up, down, or staying the same**.
Extra Credit	Additional extra credit of at most 3% will be given for in class participation
Incomplete Policy	We expect everyone to complete the course on time. However, we certainly understand that there may be factors beyond your control,

	such as health problems and family crises, which prevent you from doing so. If you feel you cannot complete the course on time, please discuss with Prof. Benson the possibility of being given a grade of Incomplete for the course and setting a schedule for completing the course over the summer.
Due Dates	All assignments are submitted electronically (via department machine handin scripts for programming projects and via Gradescope for written homework assignments) due at 11:59 pm.
Late Policy	The late-day policy described here applies to all late days other than those due to illness and religious holidays. Thus days missed because of job interviews are included in the late-day policy. Everyone is allowed a total of four late days on projects free of charge, but no more than **three late days may be applied** to any one assignment. **Except Puddlestore, you will only get two days.** Beyond that, you are penalized 10% of the assignments total worth for each day it is late. So, if the assignment is out of 100 point and you get 88 points but are one day late: then it becomes 78 points. We will apply late days to assignments in an optimal fashion (with respect to your grade). **Note that late penalties are applied after grades have been curved.** If you are ill, you may get an extension without using late days. Please get a note from either health services or the office of student life and contact one of the instructors. If you must miss an assignment deadline because of a religious holiday, you may also get an extension without using late days; please contact one of the instructors. The schedule is out please contact the instructors within the first three weeks of the course to declare such conflicts and we will plan accordingly.
Accommodations	If you feel you have physical, psychological, or learning disabilities that could affect your performance in the course, we urge you to contact SEAS (https://www.brown.edu/campuslife/support/accessibility-services/). We will do whatever we can to support accommodations recommended by SEAS.
Mental Health	Being a student can be very stressful. If you feel you are under too

	much pressure or there are psychological issues that are keeping you from performing well at Brown, we encourage you to contact Brown's Counseling and Psychological Services (CAPS: https://www.brown.edu/campus-life/support/counseling-andpsychological-services/). They provide confidential counseling. In addition, the deans of student life as well as the deans of the college can provide notes supporting extensions on assignments for health reasons.

Lectures and Due Dates

Date	Topic	Readings	Out	Due
Jan 24	L1 --- Intro to 138			
Jan 29	L2 --- D.S. Principles (RPC, Naming)	OSTEP	LiteMiner	
	Distributed Hash Tables Replication/Partitioning			
Jan 31	L3 --- Consistent Hashing (Chord)	Chapter 10		
Feb 5	L4 --- DHT Continued (Tapestry)	Chapter 10		
	Ordering			
Feb 7	L5 --- Time (Logical Clocks)	Chapter 14	HW1	
Feb 12	L6 --- Global State (Distributed Snapshots)	Chapter 14		LiteMiner
	Consensus			
Feb 14	L7 --- Consensus Intro	Chapter 15	Tapestry	HW1
Feb 19	Holiday!!!			
Feb 21	L8 --- Active Replication	Chapter 15		
Feb 26	L9 --- Passive Replication (Raft)	Chapter 15		
Feb 28	L10 – Lazy Replication (Gossip, Bayou)	Chapter 18		Tapestry

Mar 5	L11 – Distributed Transactions	Chapter 17	HW2	
Mar 7	L12 – Practical Consensus (Chubby/ZooKeeper)			
Mar 12	L13 – Byzantine Fault Tolerant	Chapter 15		
	Miscellaneous Topics			
Mar 14	L14 -- Midterm Review		Raft	
Mar 15			HW2 Due	
Mar 19	L15 – Debugging			
Mar 20	Midterm			
Mar 21	L16 -- Distributed File Systems			
Mar 26	Holiday!			
Mar 28	Holiday!			
Apr 2	Raft Help Session			
Apr 4	gRPC Lab		HW3	
Apr 9	L17 – Distributed File Systems			Raft
	Industry Applications of Distributed Systems			
Apr 11	L18 -- Industry Applications		Puddlestore	
Apr 16	L19 --- Final project discussion			
Apr 18	L20 -- Industry Applications			HW3
Apr 23	L21 -- Industry Applications		HW4	
Apr 25	L22 – Industry Applications			
May 2				HW4
May 6				Puddlestore
May 11 (2pm)	Final			