Instructions: Answer all questions as clearly as you can. Be concise. If you get stuck, state what you are trying to do in order to have a chance at partial credit.

You may use (without providing a proof) any theorem that we have proved in lecture or recitation, or which has been assigned in a problem set, or which is proven in the textbook. You may also use (without providing a proof) any theorem we stated without proof in lecture or recitation if we said you are responsible for knowing it. You may not use the statements given in problems that appear in the text without solutions and weren't assigned or covered in lecture, unless you prove them.

The exam is Open Book/Your Notes/Homepage Postings/Piazza from this year’s class. Access to these materials during the exam is allowed. Access to other books, course bibles from other years, and other materials from outside of class is not allowed. You may use a laptop or other e-reader to access the allowed materials, but internet searching is not permitted. You may not communicate with anyone except for the course staff while taking the exam.

The exam length is 3 hours. You need to complete your work within that amount of time. In addition, you are allowed 30 minutes for downloading the exam from gradescope, printing, scanning, and uploading back to gradescope. If you prefer, you may complete the exam electronically after downloading, to avoid printing and scanning it, and then upload the completed exam. Gradescope will manage the timer for your exam. If you have trouble accessing the exam, or have questions or other issues, please post privately on piazza. We will be available to respond quickly except in the middle of the night. If you have trouble uploading the completed exam, take a timestamped photo of each page and email them to me at sipser@mit.edu within the allotted time.

After uploading the exam, please assign which pages contain the solutions to each of the problems. For your convenience, we’ve printed the exam twice here in two different formats: first with all of the problems on three pages and second with each problem appearing on its own page. Please write your solutions on the pages that have the problem statements already provided. Alternatively, you may write your solutions on blank pages and then clearly write which problem and problem part(s) you are solving on each page. Use separate pages for each problem.

By submitting this exam, you are certifying that it is your own work and that you did not receive any assistance or information that is not permitted as specified above.