

# Homework 1. Due October 11, 9:59PM.

CS181: Fall 2021

## GUIDELINES:

- Upload your assignments to Gradescope by 9:59 PM.
- Follow the instructions mentioned on the course webpage for uploading to Gradescope very carefully (including starting each problem on a new page and matching the pages with the assignments); this makes it easy and smooth for everyone. As the guidelines are simple enough, bad uploads will not be graded.
- You may use results proved in class without proofs as long as you state them clearly.
- Most importantly, make sure you adhere to the policies for academic honesty set out on the course [webpage](#). The policies will be enforced strictly. Homework is a stepping stone for exams; keep in mind that reasonable partial credit will be awarded and trying the problems will help you a lot for the exams.
- All problem numbers correspond to our text 'Introduction to Theory of Computation' by Boaz Barak. So, exercise a.b refers to Chapter a, exercise b.

1. If  $S, T$  are two finite sets, prove that there is a one-to-one mapping from  $S$  to  $T$  if and only if there is an onto mapping from  $T$  to  $S$ . [1 point]
2. Exercise 2.4 [1 point]. (Note: The constant 1000 is there for slack and not a specific one.)
3. Exercise 3.3. [1 point] The problem is essentially asking you to show that you can compute AND using just OR/NOT functions.
4. Exercise 3.4. To be more precise, the problem is asking you to show that there is a function that **cannot** be computed by a Boolean circuit that is only allowed to use AND/OR (so NOT gates not allowed). As a further hint, you can show that there is a function that takes two inputs and has one output that cannot be computed in such a way (no matter how many AND/OR gates you use). [1 point]

ADDITIONAL PROBLEMS. DO NOT turn in answers for the following problems - they are meant for your curiosity and understanding.

1. Exercises 2.3, 3.1, 3.9, 3.10, 3.13, 3.14.