

CSE 203A Exam 1

Spring 2026

Instructions: Do not open until the exam starts. The exam will run for 50 minutes. The problems are roughly sorted in increasing order of difficulty. Answer all questions completely. You are free to make use of any result in the textbook or proved in class. You may use up to 6 one-sided pages of notes, and may not use the textbook nor any electronic aids other than a simple timepiece. Write your solutions in the space provided, the blank page after this one, or on the scratch paper provided (be sure to label it with your name). If you have solutions written anywhere other than the space directly beneath the problem be sure to indicate clearly where they are to be found.

Please sit in the seat designated below.

Name:

ID Number:

Seat:

This page is left blank for scratch work.

Question 1 (Expected Fixed Points, 30 points). *Given a random permutation π of $[n]$, what is the expected number of fixed points (i.e. values $i \in [n]$ so that $\pi(i) = i$) of π ?*

Question 2 (Same Row Matrix, 35 points). Given an $n \times n$ matrix A with entries in \mathbb{F}_p for $p > n^2$, give an $O(n^2)$ time **coRP** algorithm for determining whether there exist two rows of A that are permutations of each other. You may assume that \mathbb{F}_p arithmetic can be done in constant time.

Question 3 (Graph Products, 35 points). Consider two finite, undirected graphs G and H . Define a new graph $G \otimes H$ whose vertex set consists of pairs (u, v) with $u \in G$ and $v \in H$ and has edges (u, v) to (u', v') where u' is a neighbor of u and v' is a neighbor of v .

If the transition matrix of the random walk on G has eigenvalues $\lambda_1, \lambda_2, \dots, \lambda_n$ and the transition matrix of H has eigenvalues $\mu_1, \mu_2, \dots, \mu_m$, what are the eigenvalues of the transition matrix for $G \otimes H$? Justify your answer.