

MATH 474 Probability and Statistics
Spring 2026

HOMEWORK 1

Due on Canvas at 8:59pm on Wednesday, January 21.

Please write down the time you spent on this homework on the top

Problem 0 (2 points). If you have not yet read the course syllabus, please do so now. Are students allowed to use AI to solve homework problems?

Problem 1 (8 points). This question is intended for me to know your background and goals.

- (a) What is your major and which year are you in?
- (b) What are your plans after graduation?
- (c) Do you think probability and statistics will be useful in your career? If so, how?
- (d) What relevant courses have you taken?

Problem 2 (10 points). Data scientists working for an online retailer are interested in the version of the website resulting in more purchases. 10000 unique visits to the website are tracked over a single week. Each time a customer visits the website, one of two versions are loaded: Version A or Version B. The data scientists track the visits and website versions resulting in a purchase.

- (a) What is the population?
- (b) What is the sample size?
- (c) Which of the following applies in this scenario?
 - Data scientists randomly assigned each visit to the website to see Version A or Version B.
 - Visitors to the website selected Version A or Version B on their own.
- (d) Does this scenario describe an observational study or a designed experiment?

Problem 3 (10 points). Researchers plan to do an exit poll following a local election. The researchers believe polling places are similar, and decide to randomly select 15 polling places throughout the city. Each polling place is assigned a staff member. As voters leave the polling place, the staff member asks them to take a short survey. At the end of the day, 1031 voters have been surveyed.

- (a) What is the population?
- (b) What is the sample size?
- (c) Which of the following applies in this scenario?
 - Researchers influenced survey participants to vote for their preferred candidate.
 - Researchers surveyed participants without influencing their vote.
- (d) Does this scenario describe an observational study or a designed experiment?

Problem 4 (10 points). Read Chapter 1.2.2 (Processes over time) of the textbook.

- (a) In Deming's funnel experiment, how do funnel adjustments affect future errors? Explain.
- (b) In a control chart, where is the lower control limit located?

Problem 5 (10 points). Read Chapter 1.2.4 (Designed Experiments) of the textbook.

- (a) How many trials does a factorial experiment with 2 levels and 3 factors require?
- (b) Is the total trials in a fractional factorial equal to, greater than, or less than the total trials in a factorial experiment?