

STAT 302: Assignment 1

Summer 2026, Due May 20th, 11:59pm on Gradescope.

Information for All Assignments

- Assignments must be **hand written** (writing on a tablet, or pen + paper and then scanned).
 - No typed assignments will be graded.
 - If we cannot read your writing, we will not grade it.
- 5% deduction for every hour late
- No submissions after 24 hours
- Students must submit an academic concession form at least 6 hours before due date (extenuating circumstances only)
- Students are responsible for ensuring that any work submitted does not constitute plagiarism (including AI Generated solutions).
- Regrade requests must be submitted on Gradescope within three days of the assessment being returned. The instructor reserves the right to regrade the entire assessment, resulting in a higher or lower grade than originally provided.

Question 1 [6 points]

Suppose that a student's phone screentime report shows that they are scrolling Reddit 50% of days, checking Instagram 80% of days, and checking their email 10% of days. 30% of the days, the student checks Reddit and Instagram in the same day (we don't know whether or not they also check their email on these days). 17% of the days, they exclusively look at Reddit. They never check their email without opening Reddit or Instagram. 3% of the days they check all three apps.

Show your work and all calculations. You may use visuals to help you.

- (a) On a randomly selected day, what is the probability that the student checks only Reddit and their email?
- (b) On a randomly selected day, what is the probability that the student only checks Instagram, but not email nor Reddit?
- (c) What is the probability that they do not check any of the three apps?

Question 2 [8 points]

Prove the Bonferroni inequality:

$$\mathbb{P}\left(\bigcap_{i=1}^n A_i\right) \geq \sum_{i=1}^n \mathbb{P}(A_i) - (n-1)$$

Show every step of the proof. List any results, rules, or theorems you use in the respective lines of your proof.

Hint:

$$\bigcap_{i=1}^n A_i = \left(\bigcup_{i=1}^n A_i^c\right)^c.$$

Question 3 [7 points]

Prove that $\mathbb{P}(\cdot | B)$ is a probability. Hint: there are three axioms in the formal definition of a probability.

Question 4 [8 points]

A quality control inspector examines items coming off a production line and classifies each as defective (D) or non-defective (N). The inspector examines items one at a time and **stops as soon as they find 2 defective items, or after examining 4 items**, whichever comes first.

- (a) Write out the sample space Ω .
- (b) Let A be the event that the inspector stops after exactly 3 items. List the outcomes in A
- (c) Let B be the event that fewer than 2 defective items are found in total. List the outcomes in B .
- (d) What is $A \cap B$? Describe this subset in words.

How to Submit

Upload your submission to Gradescope, which is linked on Canvas.