

# CIS 160 — Mathematical Foundations of Computer Science

## Homework Assignment 9T

**Assigned:** October 26, 2021

**Due:** 8:30 AM ET, October 28, 2021

---

This homework is due electronically on Gradescope at 8:30 AM ET, October 28, 2021. To receive full credit all your answers should be carefully justified.

Please make note of the following:

**A. Standard Deductions:**

- 5 points will be deducted from your homework if you do not use the provided L<sup>A</sup>T<sub>E</sub>X template.
- 5 points will be deducted from your homework if you do not select pages when submitting to Gradescope.
- No credit will be awarded to assignments that are not typeset in L<sup>A</sup>T<sub>E</sub>X.

**B. Solutions:** Please make sure to keep your solutions clear and precise. While no points will be deducted for overly verbose solutions, clarity and brevity are important skills that can be developed through CIS 160. If multiple solutions are given, only the first one will be graded. *Solutions must be given in closed form (as defined on Piazza).*

**C. Collaboration:** You may organize into collaboration teams of up to 3 current students. For each homework assignment, you can only be in one team and must list all team members on your homework submission using the provided L<sup>A</sup>T<sub>E</sub>X template, whether or not you specifically spoke with them. You may have different teams for different assignments. Collaboration must be strictly limited to discussion, and solutions must be written separately. For the complete collaboration policy, please consult the announcement on Piazza. Violations may seriously affect your grade in the course.

**D. Citations:** All solutions must be written in your own words. If you would like to use part of a solution from a problem presented in lecture, recitation, or past homework solutions you may do so with attribution; i.e., provided you add a comment in which you make clear you copied it from these sources.

**E. Outside Resources:** Any usage of resources outside of the course materials on the course website or Canvas is strictly prohibited. Violations may seriously affect your grade in the course.

**F. Late Policy:** We will allow you to drop two homework assignments assigned on a Tuesday and two homework assignments due on a Thursday (i.e. two ‘T’ homeworks and two ‘H’ homeworks). Because of this, we will not accept late homework under any circumstances. If you will be missing school for an extended period of time due to severe illness, please notify the professor.

**1. [12 pts] Mango vs. Watermelon? Vote Here!**

Each year, the mighty watermelon tribe and the lousy mango tribe engage in a contest to determine which is the better fruit. This year, the two tribes will send their chosen representatives (Watermelinda and Yuyango the Mango) to engage in a best-of-nine rock-paper-scissors match. In other words, Watermelinda and Yuyango the Mango will play until one of them reaches five wins, at which point their tribe will be victorious and claim the title of best fruit. Assume that no game ends in a tie and that Watermelinda and Yuyango the Mango are equally matched, i.e. for each game, they are both equally likely to win. What is the probability that the winner of the first game between Watermelinda and Yuyango the Mango wins the entire tournament for their tribe?

**2. [10 pts] The Great Divide**

The great debate between watermelon and mango has divided the CIS160 staff. Representing the two sides are our fearless leaders: Sneha and Rashmi. In an effort to create peace amongst the CIS160 staff, each of them trades a member of their team to the other. Now, Sneha's team has 3 watermelon fans and 1 mango fan. Rashmi's team has 1 watermelon fan and 4 mango fans.

Suddenly, the Bossman himself descends from the heavens. He randomly chooses one member of Sneha's team and puts them on Rashmi's team. He then randomly chooses a member of Rashmi's team and finds that they are a watermelon fan. What is the probability that the member transferred from Sneha's team was a watermelon fan?

**3. [8 pts] Weilin's Watermelon's Wager**

When Weilin isn't busy being a superb CIS160 TA, she spends her time running her own fruit shop: Weilin's Watermelons. To celebrate the beginning of Autumn, Weilin's Watermelons has a special offer in order to try to increase the amount of customers. The special offer is as follows: a customer can get a free watermelon if they roll a fair six-sided die three times, and a 4 comes up exactly twice. Nicky decides to visit Weilin's Watermelons to see if he can score the free watermelon. You are able to see that Nicky rolls at least one 4, but you are unable to see his other rolls. What is the probability that Nicky rolled exactly two 4's and won the free watermelon?