2020

MATH 3100 Mathematical Thinking: Communication and Proof-sample writing (including typesetting) assignments

Min-Lin Lo
CSUSB, mlo@csusb.edu

Cory Johnson
CSUSB, corrine.johnson@csusb.edu

Shawn McMurran
CSUSB, Shawn.McMurran@csusb.edu

Laura Wallace
CSUSB, wallace@csusb.edu

Note: The section number, page number, and problem numbers mentioned below are from the book *Mathematical Reasoning: Writing and Proof* by Ted Sundstrom (available at https://scholarworks.gvsu.edu/cgi/viewcontent.cgi?article=1009&context=books)

- LaTeX Assignment #1: In your mathematics career you have been introduced to various formulas and theorems. In LaTeX, write a familiar/interesting formula or theorem that involves an equation.
    - Points of discussion
        - Importance of formatting mathematical text properly (e.g. a^2, not a^2)
        - Importance of stating hypotheses
          (e.g. The Pythagorean Theorem is not just "$a^2 + b^2 = c^2$"; The quadratic formula is actually an implication that if $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$)
        - Importance of declaring variable
    - Follow-up tasks for students
        - Revise LaTeX write-up according to comments/feedback
        - Give an incomplete theorem statement and have students complete the theorem statement. Suggested task: Choose one of the following. If you already wrote about one, do the other
            - Quadratic formula theorem
            - Pythagorean Theorem

- LaTeX Assignment #2: In Section 1.2 (problems 1-5), you have learned how to write an outline for a proof using the structure of "know-show" tables from which you developed a formal proof. In this exercise (related to problems 9-10) you will be provided with some unfamiliar mathematical definitions. Your task is to write in LaTeX a formal proof for a statement involving these definitions. There are four separate statements. In groups, each person types up a proof of a different statement. Team members will critique each other's proofs. As a follow-up, revise your proof as needed and write a reflection on how you have incorporated your peers' comments.
    - Required components of assignment: Using a LaTeX template provided by the instructor, students should
        - Provide the statement of theorem (elementary conditional statement)
        - Provide a proof in the student's own words
        - Include relevant definitions or lemmas, with citations
        - Include first and final drafts, as well as the reflection

- LaTeX Assignment #3: In Section 2.2, you learned how to create truth tables to establish logical equivalencies. Type a truth table in LaTeX for the logical equivalency assigned to you. Use the template provided by your instructor that contains some columns and rows. You will need to figure out how to add additional columns and rows.
    - Suggestions for instructor
        - Good problems to assign: Section 2.2, problems 4, 5, 6, 7, 9b, 9c.
        - Supplemental exercise: Instructor provides a set of statements to match each of the logical equivalencies and then ask students to match symbolic logic statement to written statement.

- Other writing tasks:

    1. Find a formal definition of a mathematical term (e.g. definition of a function, injective, surjective) online from a scholarly source, type it in LaTeX, cite your source, then provide an example and non-example of the definition.
    2. Critique the argument in a given proposed proof of a mathematical statement. If the argument is valid, justify. If the argument has flaws, identify those flaws and correct them to form a valid proof of the mathematical statement.
    3. For a given true mathematical implication:
        a. Construct a direct proof.
        b. Construct a proof by contrapositive.
        c. Construct a proof by contradiction.
        d. Compare and contrast parts (b) and (c). Explain their similarities and differences.