# Assignment 3, Part 1: Direct Proof Method

Start Assignment

**Due** Tuesday by 11:59pm      **Points** 100      **Submitting** a text entry box or a file upload
**File Types** pdf      **Available** until Feb 1 at 11:59pm

## Purpose

The purpose of this assignment is to study the direct method of proof and how to provide a counterexample to disprove a statement.   Understanding the concepts of proving or disproving a statement is important for improving critical thinking, analysis, and deductive reasoning, all of which are valuable in problem-solving  (**CLO 3 (https://canvas.oregonstate.edu/courses/1946372/pages/start-here-overview)** , **MLO 1-2 (https://canvas.oregonstate.edu/courses/1946372/pages/week-4-overview)** ).

## Instructions

This assignment is due by Tuesday (Week 4) at Midnight.  Late assignments must be submitted no more than 48 hours after the original deadline (with a 15% penalty every 24 hours).

I highly recommend that you try out similar examples and problems, for which the solutions are already provided at the back of the required textbook.

Write complete answers to each of the following questions. All are from the ends of the indicated sections in our text; for these, you must provide complete answers in accordance with the directions given (**in the rubric below**). Some examples of the complete answers are provided here: **HW3_Examples.pdf (https://canvas.oregonstate.edu/courses/1946372/files/103222968?wrap=1)** . **You must show your work here**. You can use the proof template provided here: **Direct Proof Template.docx (https://canvas.oregonstate.edu/courses/1946372/files/102823816?wrap=1)**

This is not a group project; do your own work. You must follow the header format as below -

First name  Last name

CS-225: Discrete Structures in CS

Homework 3, Part 1

Exercise Set #: Problem # ( ................ )

Lastly, you do not have to rewrite the questions.

# Homework Problems

Exercise Set 4.2 of the required textbook:  Question  #28 (hint: apply the algebraic formula $n^3 - m^3 = (n-m)(n^2 + nm + m^2)$ here), #36

Problem on canvas: Prove the statement "For any rational number $s$, $9s^4 + \frac{3}{7}s - 5$  is rational. (Use the definition of rational numbers, closure properties of integers, and the zero product property **only** to write down your proof. You will find a similar proof in the provided examples)

Exercise Set 4.3 of the required textbook:  Question  #39

Exercise Set 4.4 of the required textbook:  Question  #26

Problem on canvas: Prove the statement- "For all integers $a, b,$ and $c$  if $a|b$ and $a|(b^2 - c)$ , then $a|c$.

# Submission Details

Assignments should be submitted to Canvas in .pdf format. You are allowed to submit scanned handwritten answers saved in .pdf format as well.

## Academic Integrity Reminder

**Note**: completion of this assignment using work from external sources (e.g. other students or websites) is likely to cause unintended academic misconduct violations. Examples of these may include **plagiarism (https://canvas.oregonstate.edu/courses/1946372/pages/academic-integrity-at-osu)** and/or **cheating (https://canvas.oregonstate.edu/courses/1946372/pages/academic-integrity-at-osu)** .

We recognize that, in the process of completing your work, you may wish to consult various sources. Please refer to the resources in the **Academic Integrity Module (https:// canvas.oregonstate.edu/courses/1946372/modules/3118541)** , or contact your instructor if you are not sure if your work is compliant with the **Code of Student Conduct (https:// studentlife.oregonstate.edu/pre-student-conduct-community-standards)** .

## Grading Criteria

Below is the rubric that would be used to grade this assignment. This assignment will be graded within **5** days of its *due date.*

**HW3, Part 1**

| Criteria | Ratings | | Pts |
|---|---|---|---|
| **Set 4.2: Question #28, #36**<br><br>Prove or disprove the statement. If proving, use the method for writing proofs of universal statements (see section 4.2). Clearly write down the initial supposition, goal, deductions, and conclusion properly. Don't forget to mention any definitions or properties that you have used to construct the proof. Or if disproving, give a counterexample. | **30 to >28.0 pts**<br>**Full Marks**<br>Each of the answers is complete and correct. (If it is a proof, then the supposition and goal are worth 5 points, the deductions are worth 8 points, and the conclusion is worth 2 points). | **28 to >0 pts**<br>**Partial Credit**<br>--> For missing/incorrect/ incomplete: * assumption (-2.5pts) /goal (-2.5 pts)/conclusion (2pts) * justification [ "by definition"/ "integers are closed under addition/subtraction/multiplication operation"] (-2pts) --> For making algebraic mistakes ((-2) - (-5)pts) --> For an incorrect counterexample: (-10 pts) | 30 pts |
| **Problem on Canvas**<br><br>Prove the statement using the method for writing proofs of universal statements (see section 4.2). Clearly write down the initial supposition, goal, deductions, and conclusion properly. Don't forget to mention any definitions or properties that you have used to construct the proof. | **20 to >18.0 pts**<br>**Full Marks**<br>The answer is complete and correct. (The supposition and goal are worth 8 points, the deductions are worth 10 points, and the conclusion is worth 2 points). | **18 to >0 pts**<br>**Partial Credit**<br>--> For missing/incorrect/ incomplete: * assumption (-4pts) / goal (-4pts)/conclusion (2pts) * justification [ "by definition"/ "integers are closed under addition/subtraction/multiplication operation"/ "the denominator is not 0"/ "zero product property"] (-2pts) * For making algebraic mistakes ((-2) - (-8)pts) | 20 pts |
| **Set 4.3: Question #39**<br><br>Find the mistake in the proof. | **10 to >5.0 pts**<br>**Full Marks**<br>The answer is complete and correct. | **5 to >0 pts**<br>**Partial Credit**<br>The answer is incorrect or incomplete. | 10 pts |
| **Set 4.4: Question #26**<br><br>Prove or disprove the statement. If proving, use the method for writing proofs of universal statements (see section 4.2). Clearly write down the initial supposition, goal, deductions, and conclusion properly. Don't forget to mention any definitions or properties that you have used to | **20 to >18.0 pts**<br>**Full Marks**<br>The answer is complete and correct. (The supposition and goal are worth 5 points, the deductions are worth 8 points, and the conclusion is worth 2 | **18 to >0 pts**<br>**Partial Credit**<br>--> For missing/incorrect/incomplete: * assumption (-2.5pts) /goal (-2.5 pts)/conclusion (2pts) * justification [ "by definition"/ "integers are closed under addition/subtraction/ multiplication operation"/ "the denominator is not 0"/ "by | 20 pts |

| Criteria | Ratings | | | Pts |
|---|---|---|---|---|
| construct the proof. Or if disproving, give a counterexample. | points). | associative property"] (-2pts) --> For making algebraic mistakes ((-2) - | | |
| Problem on Canvas<br><br>Prove the statement using the method for writing proofs of universal statements (see section 4.2). Clearly write down the initial supposition, goal, deductions, and conclusion properly. Don't forget to mention any definitions or properties that you have used to construct the proof. | **20 to >18.0 pts**<br>**Full Marks**<br><br>The answer is complete and correct. (The supposition and goal are worth 8 points, the deductions are worth 10 points, and the conclusion is worth 2 points). | (-5)pts) --> For an incorrect counterexample: (-10 pts)<br>**18 to >0 pts**<br>**Partial Credit**<br><br>-> For missing/incorrect/ incomplete: * assumption (-4pts) / goal (-4pts)/conclusion (2pts) * justification [ "by definition"/ "integers are closed under addition/subtraction/multiplication operation"/ "the denominator is not 0"/ "by zero product property"] | | 20 pts |
| General Deductions<br><br>Late Penalty - 15% deduction for each day late up to two days. | **0 pts**<br>**Deduction Rules**<br><br>The submission is – - Late by 10 minutes – 24 hours (-15 points) - Late by >24 hours – 48 hours (-30 points) - Late by >48 hours (-100 points) | (-2pts) --> For making algebraic mistakes ((-2) - (-8)pts) | **0 pts**<br>**No Deductions** | 0 pts |
| | | | Total Points: 100 | |