

CS1800

Fall 2025

Recitation 11 - Practice Questions for Homework 7

November 19 & 20, 2025

Recitations

CS1802 Recitations are dedicated time set aside to work on practice problems that specifically prepare you for the current homework or upcoming quiz.

Recitations are in-person and attendance is expected.

The solutions are published at the same time as the problems, so you can check your work. There is no need to submit anything.

Approaching the Problems

These practice problems are labelled according to which Homework or Quiz topic they will help you prepare for. You do not need to complete every practice question; we encourage you to do at least one per topic, and to prioritize the topics you would like to practice.

Instructors & Teaching Assistants

Your recitation is led by a Khoury College professor, assisted by a knowledgeable and wonderful Teaching Assistant. Professors and TAs are fantastic resources, and you have the opportunity in recitation to work with them in a smaller group -- I strongly recommend you take advantage of the time to review your solutions to these practice problems, ask for help on the homework, or review material from lecture.

Practice Problems for (HW7, Q1) - Summations

A Use mathematical induction to show the following summation.

Predicate $P(x)$ states that $\sum_{i=1}^x 2i = (x)(x + 1)$

Logic Statement: $\forall n \in \mathbb{Z}^+ P(n)$

B Use mathematical induction to show the following summation:

Predicate $P(x)$ states that $\sum_{i=1}^x \frac{1}{i(i+1)} = \frac{x}{x+1}$

Logic Statement: $\forall n \in \mathbb{Z}^+ P(n)$

Practice Problems (HW7, Question 2) - Inequality

A Prove by induction that the following logic statement is true for all integers $n \geq 9$.

Predicate $P(x)$ states that $6x + 8 < x^2$

B When we cover the growth of functions toward the end of the semester, we'll rely on the assumption that exponential functions grow slower than factorial functions, e.g., that $3^n < n!$. Prove by induction that the statement is true for all integers $n \geq 7$.

Predicate $P(x)$ states that $3^x < x!$

Practice Problems for (HW6, Question 3) - Divisibility

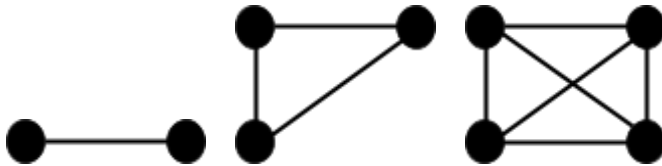
Use mathematical induction to prove the following predicate.

Predicate $P(x)$ states that $7^x - 2^x$ is a multiple of 5.

Practice Problems for (HW6, Question 4) - Data Structures

Like a set, a graph has certain properties that we can prove with mathematical induction. We'll be covering more about graphs starting on Friday, but for now all we need to know is that a graph is a collection of vertices and edges.

One type of graph is known as a *complete graph*; there is an edge between every pair of vertices. Here are examples of a complete graphs:



Notice that...

- The complete graph with two vertices has one edge.
- The complete graph with three vertices has three edges.
- The complete graph with four vertices has six edges.

It's all part of a pattern that we can prove!

Use mathematical induction to show that the number of edges in a complete graph with n vertices is $\frac{(n)(n-1)}{2}$.

Predicate: $P(x)$ states that a complete graph with x vertices has $\frac{(x)(x-1)}{2}$ edges.