MTH 225: Discrete Structures for Computer Science 1

Daily Preparation, Module 11A: Solving recurrence relations

Due by: 11:59pm ET, **Tuesday, November 17**

Estimated time requirement: About 45-60 minutes for the whole assignment. *If you have worked on this assignment for 30 minutes and you're not at least halfway done, DON'T work any further* — instead, *stop and ask for help* on the `#dailyprep` channel on CampusWire. Remember these are graded just on completeness and effort — try to be right and understand everything, but don't get bogged down if you get stuck. Just give a good effort and move on, and ask a question.

Overview

Module 11 is focused entirely on *recurrence relations*, which we first encountered when studying the binomial coefficient (Module 7B) and studied in further detail in Module 10. We saw that a recurrence relation is a recursive way of defining a sequence of integers, and that those recursive definitions can sometimes also be written as *closed formulas* that allow us to directly compute a term of a sequence without recursion. In Module 11A, we're going to look at some techniques for coming up with closed formulas for recurrence relations and how to check to see if a closed formula actually "solves" a recurrence relation. Two specific ways are discussed here – *telescoping* (looking at the differences between terms and seeing if a pattern emerges when we add those differences up) and *iteration* (writing out partial sums of a sequence and looking for a pattern).

What you will learn

Learning Targets addressed in this module:

- **SR.3 (Core)**: I can find closed-form and recursive expressions for arithmetic and geometric sequences and find their sums.
- **SR.4:** I can use iteration and characteristic roots to solve a recurrence relation.

BEFORE your class meeting, use the Resources for Learning (below) to learn how to do the following:

- Explain what it means to "solve" a recurrence relation and what a "solution" to a recurrence relation is.
- Given a proposed solution for a recurrence relation, prove or disprove that it actually solves the recurrence relation.

DURING AND AFTER your class meeting, you will learn how to do the following:

- Given a sequence of integers, determine a recurrence relation for it; guess a solution; then prove or disprove that your guess is correct.
- Solve a recurrence relation using the techniques of telescoping or iteration.

Resources for Learning

Reading: Read through Section 2.4 of the Levin text, only up through Example 2.4.5. (Module 11B picks up with "The Characteristic Root Technique".)

Video: No *required* videos this time; in fact a lot of YouTube videos on this are not great (or are well made but focus on a technique we are not covering in Module 11A) so be careful if you go searching.

Exercises

The exercises are on the following Google Form:
https://docs.google.com/forms/d/e/1FAIpQLScTl6ZFuNu6F6R4klSt5ONwpu_mYRI_UjLsAW1X_PMKhtSbvQ/viewform

Submission, grading, and getting help

Submitting your work: Your work is to be done on Classkick using the link/code above. Classkick saves your work as you go, so there's nothing to submit – just do the work and you're good.

How this is graded: Daily Prep assignments are graded on the basis of *completeness and effort*: If your submission has **all parts completed** (no blank entries, even if left blank accidentally) and **a good-faith effort to provide a correct solution or explanation is given** (no responses of "I don't know" or "I didn't understand") and **the work is submitted on time**, it gets a "check". Otherwise it gets an "x". If you are stuck on an item, you're expected to ask questions and give your best effort.

Getting help on this assignment: *You may work with others on this assignment, but you may not copy each others' answers.* Evidence of copying will be treated as academic dishonesty. You may also ask questions on the #dailyprep channel on CampusWire, but you may not ask simply to be given the answers; giving and receiving answers on CampusWire will be treated as academic dishonesty.