MTH 225: Discrete Structures for Computer Science 1

Daily Preparation, Module 7A: The Additive and Multiplicative counting principles

Due by: 11:59pm ET, Sunday, October 18

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

Today we begin a three-module block on **counting**. Seems elementary, but we are going to be counting some fairly complex arrangements that are very hard to do just using our fingers and toes. For example, how many ways are there to be dealt a three-of-a-kid in standard poker? How many function calls are necessary to traverse the entries of two linked databases? Instead of *enumerating* the possibilities (= just listing all possible outcomes) we'll develop some mathematical principles for doing this without enumeration. We start with the simplest of these – the **Additive Principle** and the **Multiplicative Principle**.

What you will learn

Learning Targets addressed in this module:

- **C.1 (Core)**: I can use the additive and multiplicative principles and the Principle of Inclusion and Exclusion to formulate and solve counting problems.
- **C.2**: I can calculate a binomial coefficient and correctly apply the binomial coefficient to formulate and solve counting problems.

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

- State the Additive and Multiplicative Principles.
- Given an arrangement to count, determine whether the Additive Principle, the Multiplicative Principle, or neither applies.
- State the Additive and Multiplicative Principles in terms of set operations.
- Find the cardinality of a union of two sets.

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

- Use the Additive Principle to count the number of ways a pair of disjoint events can occur.
- Use the Multiplicative Principle to count the number of ways a linked pair of events can occur.
- Find the cardinality of a union of three sets.
- Explain the Principle of Inclusion/Exclusion (PIE).

Resources for Learning

Text: Read all of Section 1.1 from *Discrete Mathematics: An Open Introduction.* The interactive exercises at the end are excellent for testing your understanding — make sure you try some of them.

Video: Here's a collection of videos from YouTube that are all good for learning. You don't need to watch all of them, since they are all on the same idea. So, mix and match (or find your own).

- The Addition and Multiplication Principles (11:50) https://www.youtube.com/watch?v=yTsbGglDo04 <-- Bonus: An awesome New Zealander accent.
- Multiplication principle (10:11) https://www.youtube.com/watch?v=sEul6TMYDY0
- Rule of Sum and Rule of Product (9:22) https://www.youtube.com/watch?v=8JiWWvEoaoc

You are free to search for and use other resources in addition to, or instead of the above, as long as you can work the exercises below.

Exercises

The exercises are on the following Google Form: https://bit.ly/3jKDuZS

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.