Section 1

CSE 312

-administrivia-

welcome!

Announcements & Reminders

- **Section Materials**
  - Paper will be provided in at each section
  - Worksheets and sample solutions will be available on the course calendar later this evening

- **Office Hours**
  - We start holding office hours Friday!
  - Times posted on the calendar on the course website

- **PSet 1**
  - Due Wednesday 7/1 @ **11:59pm**

Homework

- **Submissions**
  - LaTeX (highly encouraged)
    - overleaf.com
    - template and LaTeX guide posted on course website!
  - Word Editor that supports mathematical equations
  - Handwritten neatly and scanned
- Homework will typically be due on **Wednesdays at 11:59pm** on Gradescope
- Each assignment can be submitted a **max of 48 hours** late
  - You must make a meaningful attempt (some initial working to indicate that you have read the problem) on the homework by the due date, otherwise a penalty will be applied for every day submitted late

Resources

- Textbook/notes
- Section problems
- Cheatsheet
- EdStem/OH (to not only ask your own questions but hear others)

Your TA(s) :)

- [add some info about yourself!]

-ice breaker-

welcome!

Icebreaker :)

- Small groups of 4-6ish
- Please share with your group
  - Your name
  - Number of years in department/ at UW
  - What was something fun you did over Spring break?
  - What are you concerned about for 312 / what are you excited about?
- Then, share how you like to eat your potatoes (baked, fried, chips, etc)
- We'll go around and see what style of potato is most popular!

-content review-

counting 😎

Any lingering questions from this last week?

Each week in section, we'll be reviewing the main concepts from this week and putting them into action by going through some practice problems together. But before we get into that review, we'll try to start off each section with some time for you to ask questions. Was anything particularly confusing this week? Is there anything we can clarify before we dive into the review? This is your chance to clear things up!

Counting

We've been talking about how to ***count*** the size of a set of objects or number of ways a different set of events could occur!

___ RULE _________

If we want to choose from ***either*** `n` options ***or*** `m` options, ***with no overlap,*** there are _____ options in total.

SUM RULE

If we want to choose from ***either*** `n` options ***or*** `m` options, ***with no overlap,*** there are `n+m` options in total.

useful when there are multiple non-overlapping possibilities

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_____ RULE_____

If we have a ***sequential process*** where there are `m1` choices in the first step, `m2` choices in the second step, and `m3` choices in the third step, there are _____ options in total.

SUM RULE ---------

If we want to choose from *either* `n` options *or* `m` options, *with no overlap,* there are `n+m` options in total.

useful when there are multiple non-overlapping possibilities

PRODUCT RULE -----

If we have a ***sequential process*** where there are `m1` choices in the first step, `m2` choices in the second step, and `m3` choices in the third step, there are `m1 * m2 * m3` options in total.

useful when can describe creation of an object in your set via a sequence of choices.

Permutations

useful to count when order does matter

If you want to re**order** `k` **distinct** elements, there are `k!` ways - `k * (k-1) * ...`

If you want to choose a **sequence** of `k` elements from a set of `n` elements, there are `(n! /(n-k)!)` ways

Combinations

(binomial coefficient)

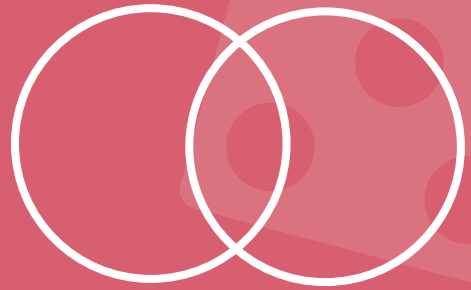
useful to count when order does not matter (e.g., choosing a subset)

If we want to choose a **set** of n elements from a group of k distinct elements, there are options $\binom{n}{k} = \frac{n!}{k!\,(n-k)!}$

you can also just write it as C(n,k)

Inclusion/exclusion

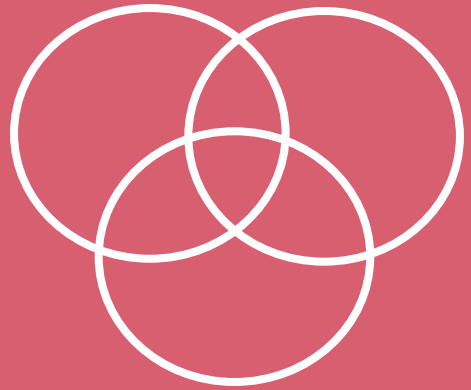
$$|A \cup B| = |A| + |B| - |A \cap B|$$



$|A \cup B \cup C|$ *is*

singles - doubles + triples

$$|A| + |B| + |C| - |A \cap B| - |A \cap C| - |B \cap C| + |A \cap B \cap C|$$



LET'S GET TO SOME PROBLEMS :)

Problem 1(a) (Seating)

How many ways are there to seat 10 people, consisting of 5 couples, in a row of 10 seats if all couples are to get adjacent seats?

Work on this problem with the people around you and then we'll go over it together.

Hint: Treat each couple as a "unit".

Problem 1(b) (Seating)

How many ways are there to seat 10 people, consisting of 5 couples, in a row of 10 seats if one couple insists on NOT sitting in adjacent seats?

Work on this problem with the people around you and then we'll go over it together.

Hint: Complementary counting!

Problem 4 (Escape the Professors)

There are 6 security professors and 7 theory professors taking part in an escape room. If 4 security professors and 4 theory professors are chosen and paired off, how many pairings are possible?

Work on this problem with the people around you and then we'll go over it together.

Hint: Product rule (choose security profs, then theory profs, then pairings)

Problem 3 (HBCDEFGA)

How many ways are there to permute the 8 letters A, B, C, D, E, F, G, H so that A is not at the beginning and H is not at the end?

Work on this problem with the people around you and then we'll go over it together.

Hint: Complementary counting + Principle of Inclusion/Exclusion (PIE)

Problem 3 (HBCDEFGA)

How many ways are there to permute the 8 letters A, B, C, D, E, F, G, H so that A is not at the beginning and H is not at the end?

More hints:
Define S = set of all possible permutations of 8 letters
Define E_A = set of all permutations where A is at beginning
Define E_H = set of all permutations where H is at end

In terms of the above sets, what is the set we are trying to count?

Then apply Complementary counting + PIE

Problem 15 (Binomial Theorem)

What is the coefficient of z^{36} in $(-2x^2yz^3 + 5uv)^{312}$?

Reminder: The Binomial Theorem says that

$$(a+b)^n = \sum_{k=0}^{n} \binom{n}{k} a^k b^{n-k}$$

Hint: In the expression $(-2x^2yz^3 + 5uv)^{312}$ what is a and what is b?

Problem 10 (Extended Family Portrait)

A group of n families, each with m members, are to be lined up for a photograph. In how many ways can the nm people be arranged if members of a family must stay together.

Work on this problem with the people around you and then we'll go over it together.

That's all folks :)

See you next week!