* Addie Jordon (he/they)
* [addie@uvic.ca](mailto:addie@uvic.ca)
* Masters in Quantum Computing
* [www.menti.com](http://www.menti.com) 8650 5033
* Office: ECS 261
  + Wed & Friday 10:30-11:30, Wed 2:00 - 3:00
* 284464
* 2 midterms
* 1 final
* 5 written assignments
* 2 programming assignments
* [http://discrete.openmathbooks.org](http://disctete.openmathbooks.org)
  + Discrete Mathematics an Open Introduction
  + Textbook
* Argue for your marks & ask for a regrading
* Proofs
  + Proof by Construction
    - Prove that there exists a function that can add two numbers
      * Prove by simply writing it
  + Proof by Contrapositive
    - p->q ⇔ ~p->~p
  + Proof by Induction
    - Extremely powerful
    - Shows that properties hold infinitely
    - Eg
      * All cats are either blue or red. All cats sit in a line
      * Function c(x) returns the colour
      * If two cats, a and b, are beside each other, c(a) = c(b)
      * What do we know if the first cat in the line is red?
        + All cats are red
  + Proof by Contradiction
    - Assume the opposite
    - Arrive at a contradiction
    - Eg
      * Proof by contradiction that there is no largest number
* Counting
  + **Additive Principles**
    - 14 rabbits and 9 rats
    - You may adopt only 1. How many choices do I have?
    - 14 + 9
    - Additive Principle |A| + |B| = |AUB|
    - Disjoint
  + One rabbit and one rat
    - 14x9
    - **Multiplicative Principle**
    - |A X B| = |A| \* |B|
      * X Cartesian product
        + {(1,1),(1,2),(1,3),...,(2,1),(2,2),(2,3)...(14,9)}
* **Permutations with no repetition**
  + S = {red, orange, yellow, green}
  + Order matters
  + How many different ways can we stack the blocks?
  + 4x3x2x1 = 4!
  + Formal definition:
    - P(n,k) = n! / (n-k)!
      * n, number of objects
      * k, choosing k objects
* **Permutations with repetition**
  + S = {red, orange, yellow, green}
  + Suppose we are stacking 4 different coloured blocks, but now colors can be repeated
    - 4^n
* **Combinations with no repetition**
  + S = {red, orange, yellow, green}
  + Combinations: order doesn’t matter
  + Suppose we put 4 blocks into a bag
  + How many different ways can we choose blocks?
    - (n C k), or C(n,k)
      * Note: C(n,n) = 1
    - C(n,k) = n! / k!(n-k)!
  + Overcounting error:
    - n\*k
    - Fix by (n\*k / 2)
* **Combinations with repetition**
  + S = {red, orange, yellow, green}
  + Order doesn’t matter
  + Suppose we put 2 blocks into a bag
  + How many different ways can we choose blocks?
  + C(n+r-1, r) = (n+r-1)! / r!(n-1)!
  + Review textbook if you need to
* **Pigeonhole principle**
  + Given n pigeons and n-1 holes, then there must be at least one hole with at least two pigeons
  + Eg: You have 10 green socks and 10 blue socks. How many socks do you have to draw in order to get a pair?
    - 3