What's in Discrete Math that we did not cover

- More on recurrences, Katalan numbers, Stirling numbers integer partitions (chap. 6)
- Asymptotic solutions of recurrences, Master theorem
- Probability: Random variable, expectations, generating functions.
- Group theory / permutations
- Graph coloring (chap. 8)
- Block design / designs (coding theory)
- More about algorithms.

- Graphs: vertecies, edges, paths, cycles, ...
  - Trees, properties of trees.
  - Planar graphs.

  Formulas associated with graphs.
  - Handshake Lemma
  - $V - e + f = 2$ (planar connected graph)
  - Planar graph: sum of degrees of faces $= 2 \times e$
  - Tree: $e = V - 1$

- Number theory: gcd, Euclidean Alg, modular arith. inverses modulo p, solving linear equations mod p

congruence relation (equivalence relation)

- Equivalence Relation (Refl., Symm, Trans.)
- Partial order Relation (anti-symmetric, transitive)

- Recurrences: especially $a_n = Aa_{n-1} + Ba_{n-2}$
  (characteristic equation)
  Drop: generating functions
  - Induction
  - Counting

- Proofs: Induction, direct proofs, proof by contradiction, contrapositive, existential proofs, pigeonhole

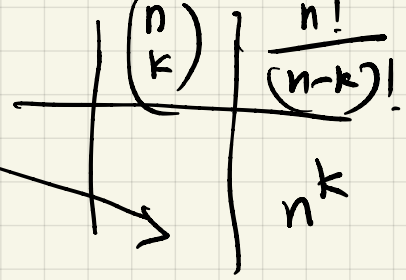
- Inclusion-Exclusion: (counting)
- Product rule, addition rule, binomial coefficients

$\binom{n}{k}$ = # subsets of size k if $S = \{1, 2, \dots, n\}$

Sum and product notations $\sum$, $\prod$

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

sol: $x_1 + x_2 + \cdots + x_n = k$ is $\binom{n+k-1}{n-1}$



- Functions: onto, one-to-one, bijection

drop: Cardinality of infinite sets, countable vs. uncountable

Establishing bijection to prove two sets have the same size, diagonalization.