Review:

1 recurrence relation
Use generating functions to find a solution

2 binomial coefficient theorem
$\binom{m}{n}$ m can be generalized to non integer
$= m(m-1)\dots(m-n+1)$

3 integer functions
$\lfloor x \rfloor$ the greatest integer $\leq x$
i.e $\lfloor x \rfloor = 1$ then $1 \leq x < 2$ or $x \in [1,2)$

4 pigeonhole principle

5 graph theory
- complete graph K_n
- trees
- colouring questions — chromatic polynomial
  - ramsey #
  - chromatic #

6 distribution problems
- partition of integers
- recurrence relation through young diagram

number of partitions of integers
- use generating functions

7 principle of inclusion and exclusion
- counting the size of unions of sets
- famous examples: 2nd sterling # (onto functions)
  - derangement: permutation w/ no fixed point

8 group action
- permutation group: symmetry group, dihedral group, cyclic group $\mathbb{Z}$, $\mathbb{Z}/n\mathbb{Z}$
- orbit-stabilizer theorem + Burnside's lemma
  - # of colorings invariant under certain symmetries
- polya's formula: cycle index

9 Euclidean algorithm
- $\gcd(m,n) = am + bn$
  - $a, b \in \mathbb{Z}$

$\mathbb{Z}$ and $\mathbb{Z}/n\mathbb{Z}$ as cyclic groups
congruence class