COURSE OUTLINE (PART 1)

BASIC COMBINATORICS

In how many ways can one choose k objects from a collection of n objects?

- order matters / doesn't matter
- repetition allowed / not allowed

PRINCIPLE OF INCLUSION AND EXCLUSION

COUNTING THE NUMBER OF FUNCTIONS $f: A \to B$ (A, B finite)

- all
- injective
- surjective

RECURRENCE RELATIONS

Ex $a_{n+2} - 7a_{n+1} + a_n = 2^n$

solve for a_n

Come from recursive descriptions in computer science etc.

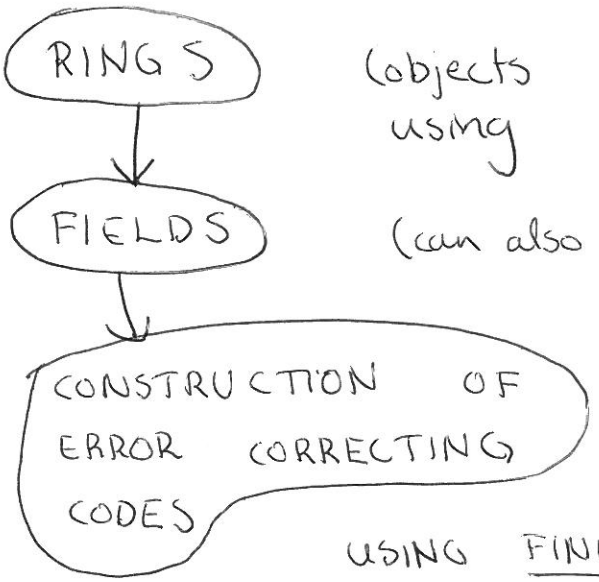
GENERATING FUNCTIONS

but also complicated combinatorial questions:

In how many ways can we distribute 17 apples among 4 children if one wants an odd number of apples, one at most five, one at least three etc.

THE PIGEONHOLE PRINCIPLE

PART II



(objects where we can count using $+, -, \cdot$)

(can also use $/$)

What is error correcting codes?

We transfer some information (string of symbols) from person A to person B.

Ex Find errors The control digit in the personal identification number

Ex Correct errors Send every symbol three times.

SSSOOOAAAPPP instead of SOAP f. ex.

If we receive SSSOUO AAARPP we take the letter appearing at least twice in each triple

SSS OUO AAA RPP

↓ ↓ ↓ ↓

S O A P

Correct if not more than one error in any sequence of three symbols.