

1. List decoding

1. Consider an n -character message encoded into $m = n + k$ characters over the field $GF(p)$ using polynomials. Suppose that one receives $n - 1$ of the m packets. Give a method to find a list of size at most p of all possible n -character messages.

2. Consider an n character message encoded into $m = n + 2k$ characters over the field $GF(p)$ using polynomials. Suppose that $k + 1$ of the m received packets are corrupted. Give a method to find a list of all possible messages which contain the original message. What is the size of the list for your scheme?

3. Consider the protocol in (b) where we are working in $GF(7)$. Let the original message have $n = 1$ and $k = 2$, so there are 5 symbols. Now suppose that there are 3 errors, but these three errors all landed on different values. Assume that we received: 0, 0, 1, 2, 3. How does your list-decoding strategy perform?

2. Pokemon Counting!

1. I have caught 30 different Pokemon so far. In how many ways can I choose a team of 6, such that the order of my team matters?

2. For this part and the next two, you can assume we no longer care about the order of the Pokemon. In how many ways can I choose a team of 6 under this assumption?
3. Among my 30 caught Pokemon, only 4 can learn the move “Fly”. In how many ways can I choose a team of 6, such that there is **exactly** one Pokemon who knows the move “Fly”?
4. In how many ways can I choose a team of 6, such that there is **at least** one Pokemon who knows the move “Fly”?
5. You were victorious against the Elite Four, and Professor Oak generously invited all six members of your team to the Hall of Fame. Suppose he wants to sit your team in a circular table for dinner (which consists of only Oran Berries), in how many ways can he do so?
6. Suppose Charizard and Pikachu, two members of your team, want to sit next to each other. How would your answer to the above question change?
7. Suppose Meowth and Pikachu, two members of your team, don’t want to sit next to each other. In how many ways can Professor Oak arrange the seatings?

3. Pokemon Anagrams

An anagram of a word is any re-ordering of the letters of the word, in any order. It does not have to be an English word or an actual Pokemon name.

1. How many different anagrams of PIKACHU are there?
2. How many different anagrams of KADABRA are there?
3. How many different anagrams of RATTATA are there?