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Lecture 19: Programming Practice (review list, for-loop, recursion)

CS 1110

Introduction to Computing Using Python

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Some live coding today

- Practice developing code
  - Will use Atom, command line, diagrams
  - Will experiment (just try things out!)
  - Watch me make and correct mistakes. It's cool!
- Review list, for-loop, recursion
- Demonstrate two sorting algorithms. Think of them as applications of list, loop, recursion—you don't need to know these algorithms. But know that recursion is awesome for sorting ☺
- Show why defining our own *custom classes* may be useful (next topic)

Find min value in a list

- … without using built-in min function
- We can come up with our own algorithm!
- Good opportunity to review list and for-loop

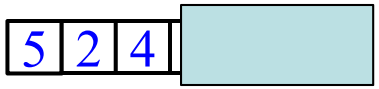
At each step check against min-so-far, NOT to previous value

Suppose you see only one value of the list at a time:

What's the min value so far? 5

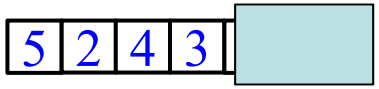
What's the min value so far? 2

Compare new value to min-so-far, update min-so-far



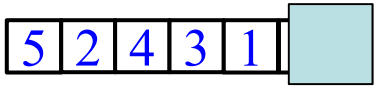
What's the min value so far? 2

Compare new value to min-so-far, keep min-so-far



What's the min value so far? 2

Compare new value to min-so-far, keep min-so-far



What's the min value so far? 1

Compare new value to min-so-far, update min-so-far

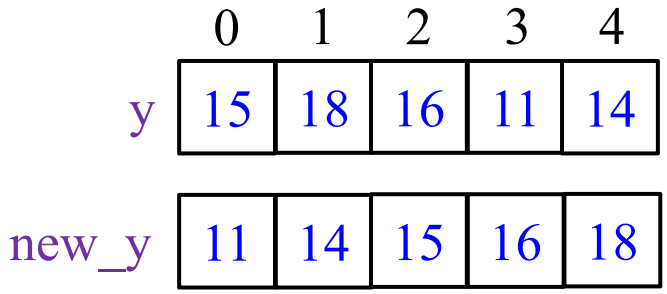
What's the min value so far? 1

Compare new value to min-so-far, keep min-so-far

See coding demo on video

Simple idea for sorting

- Pick the smallest value
- Put it at index 0 of a new list



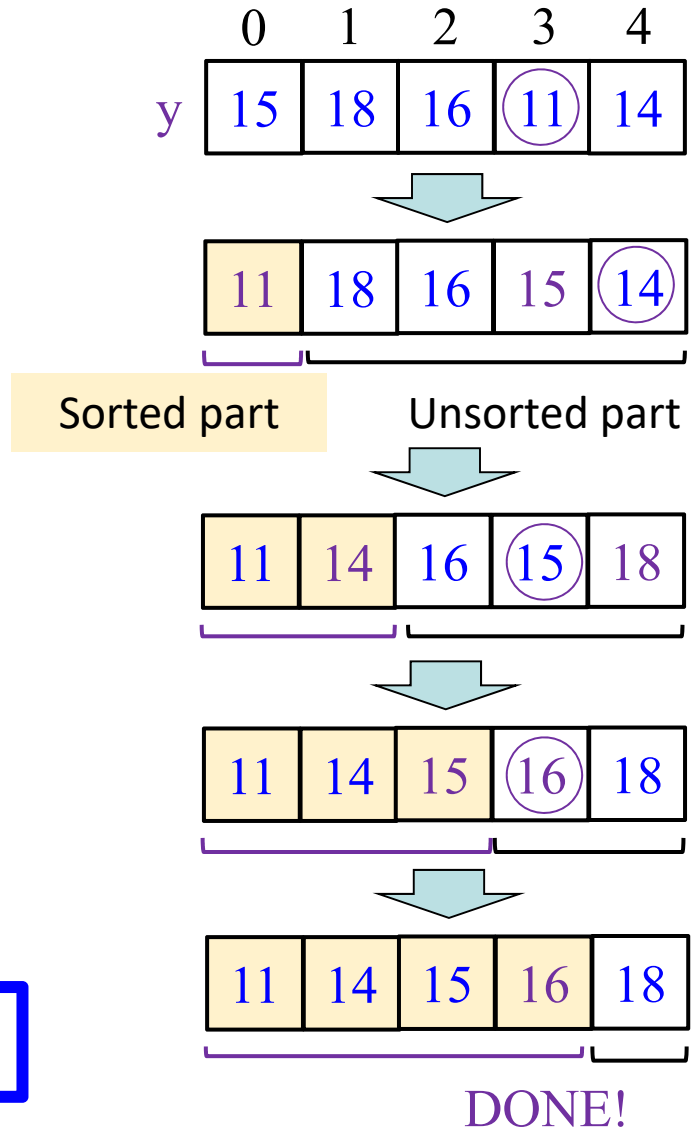
- Pick next smallest value

- Put it in the next position
- …

Can we make do without a whole other list?

- Pick the smallest value
- ~~Put it at index 0 of a new list~~
- **Swap** it with element at index 0. Use same list!
- ~~Pick next smallest value~~
- Pick smallest value starting at index 1—in unsorted part
- ~~Put it in the next position~~
- **Swap** it with element at index 1—start of unsorted part
- …

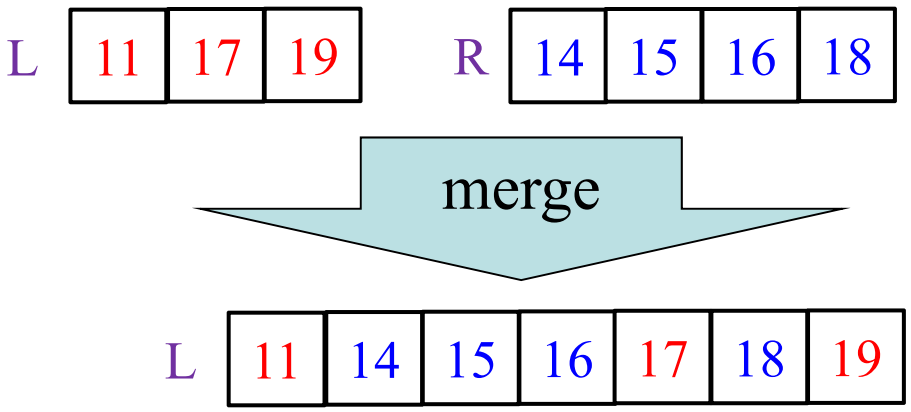
Selection Sort



See coding demo on video

Which algorithm does Python's sort use?

- Recursive algorithm that runs much faster than selection sort for the same size list (when the size is big)!
- A variant of an algorithm called "merge sort"
- Based on the idea that sorting is hard, but *"merging" two already sorted lists is easy*.



I give you function merge. (Straight forward but requires a kind of loop that you haven't seen yet.)

Let's think about the recursive aspect!

Merge sort: Motivation

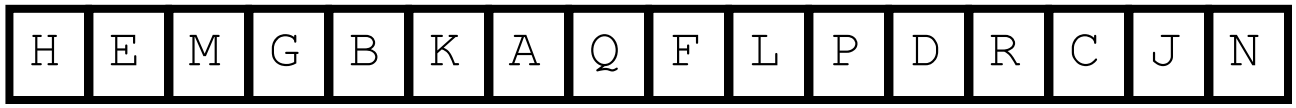
Since merging is easier than sorting, if I have two helpers, I'd…

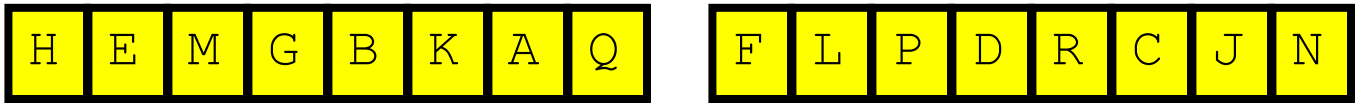
- Give each helper half the array to sort
- Then I get back their sorted subarrays and merge them.

What if those two helpers each had two sub-helpers?

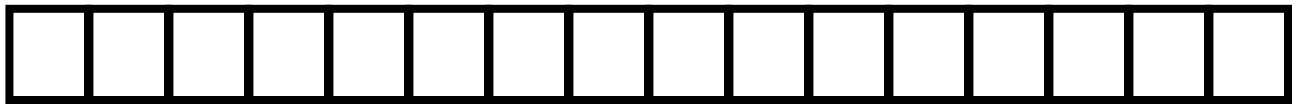
And the sub-helpers each had two sub-sub-helpers? And…

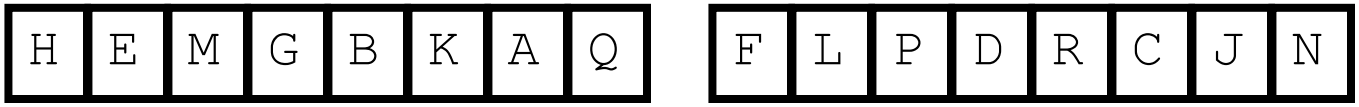
Subdivide the sorting task

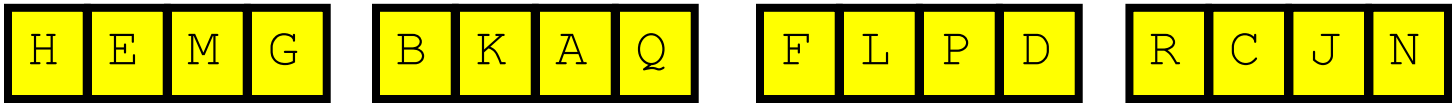




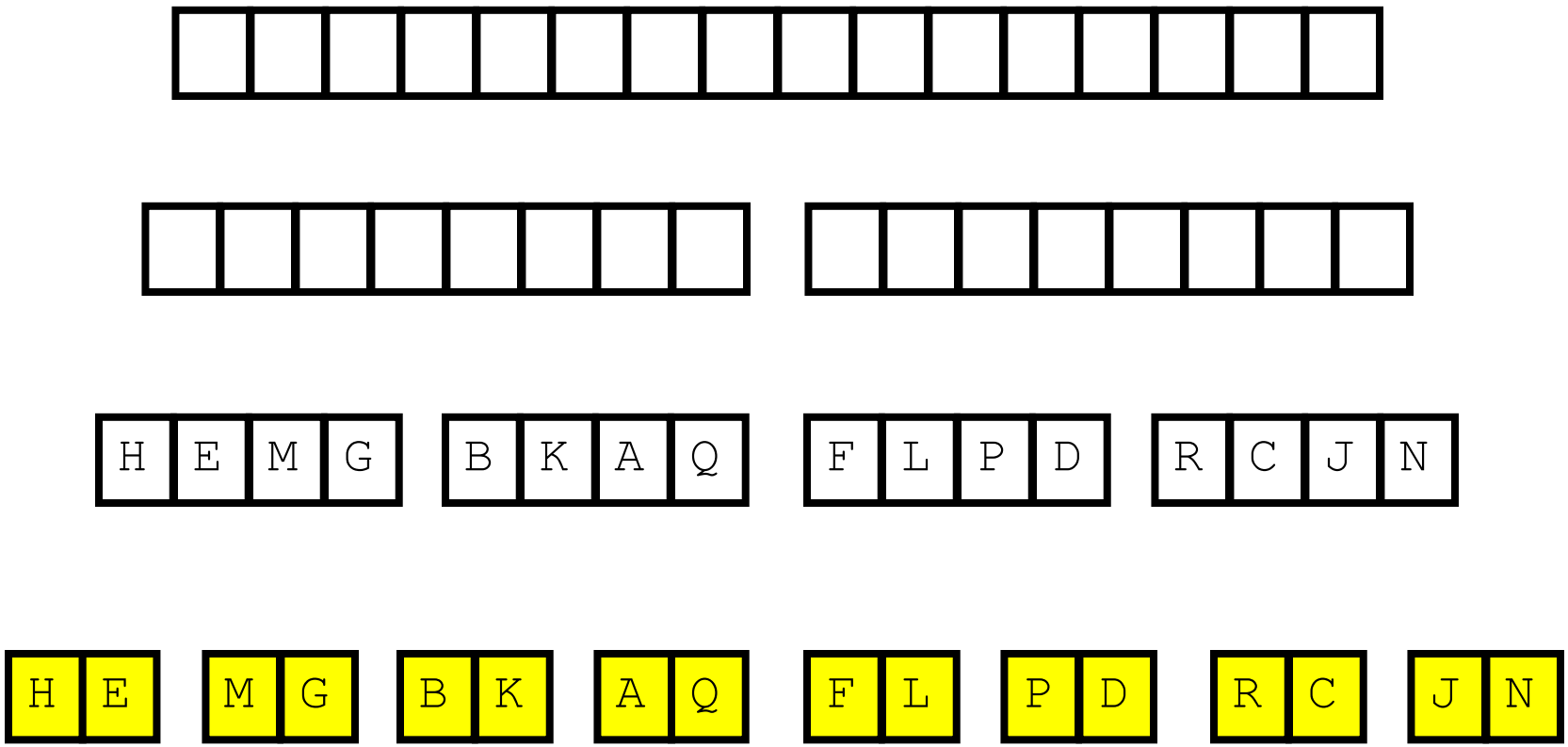
Subdivide again



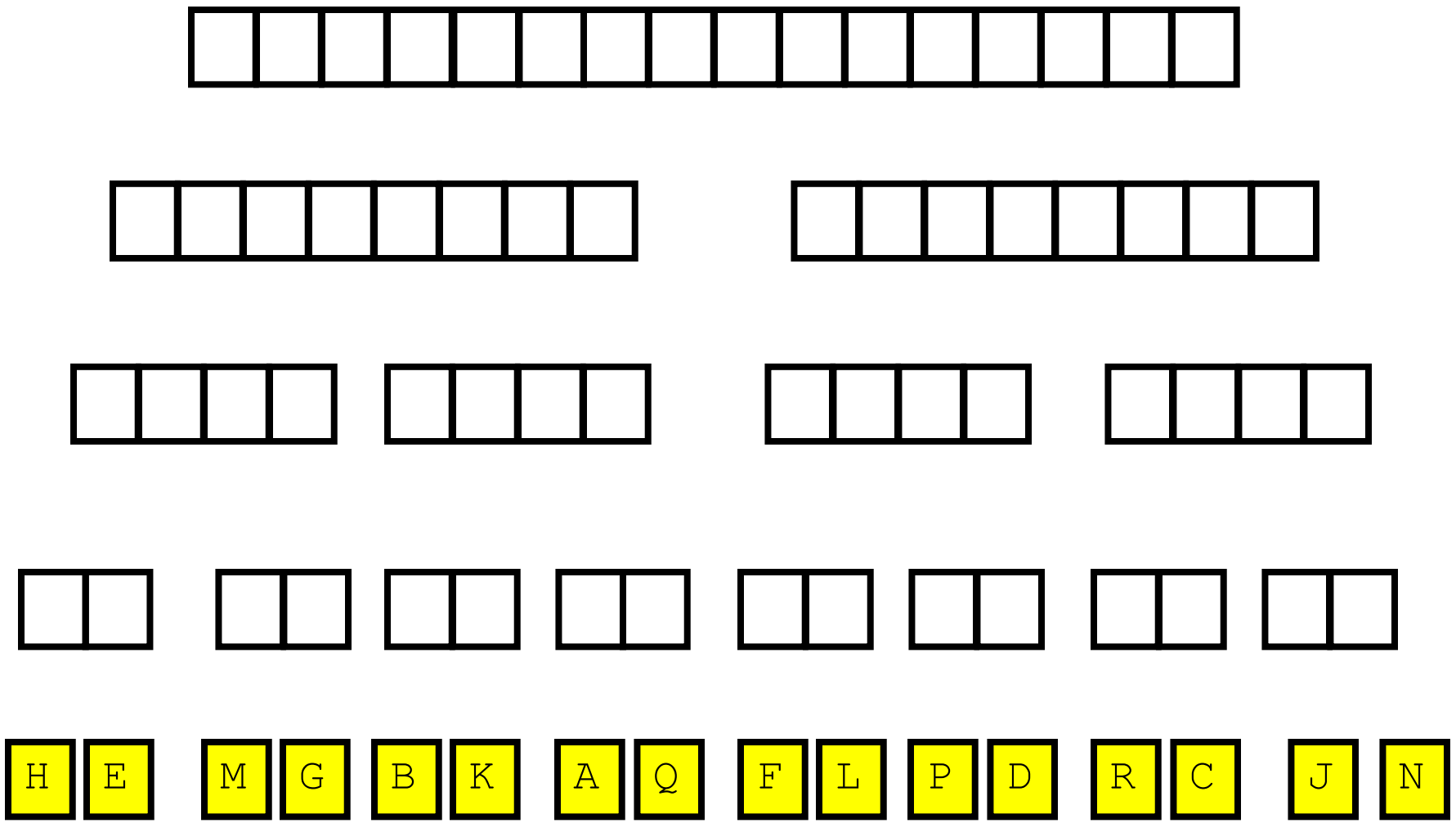




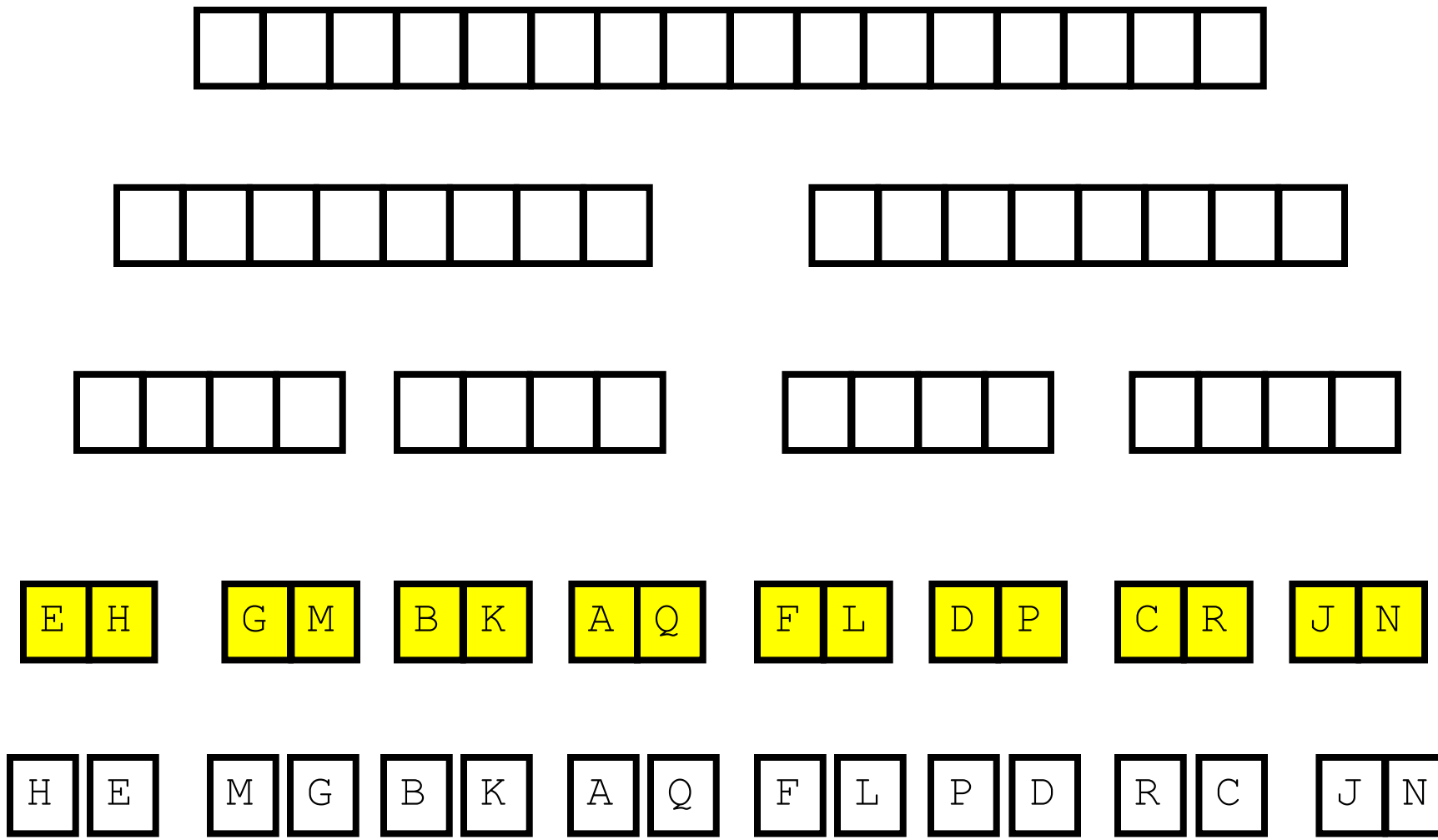
And again



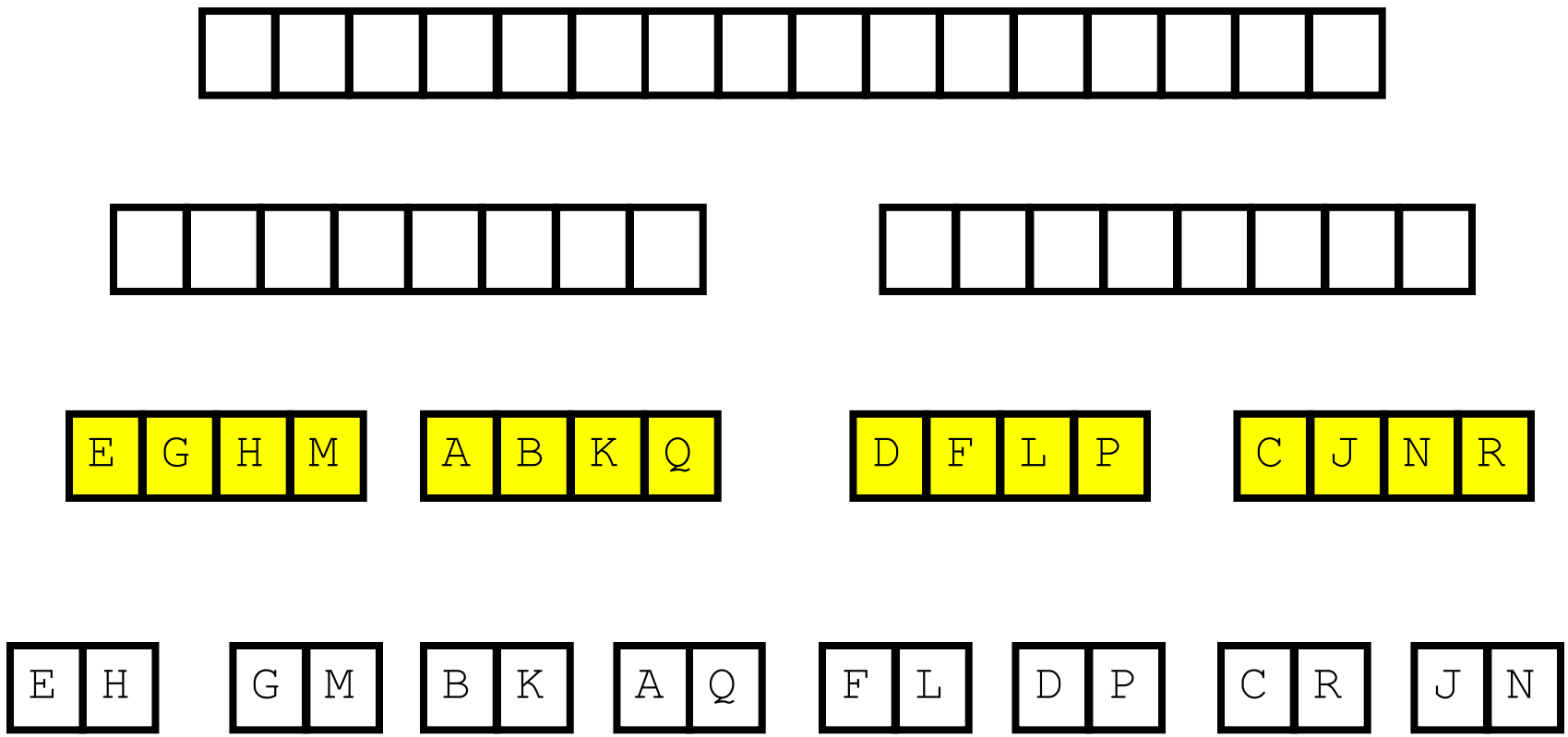
And one last time



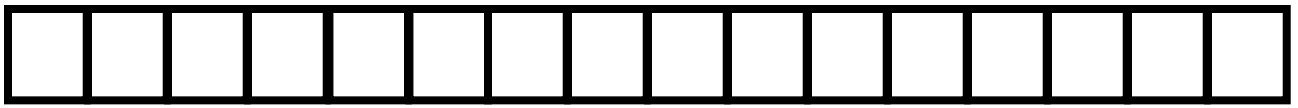
Now merge

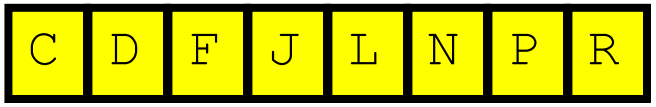


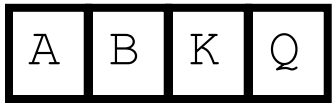
And merge again

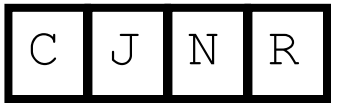


And again

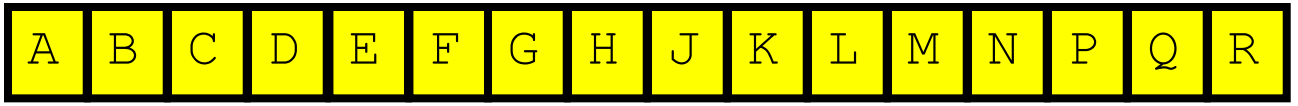


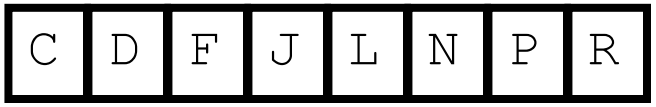




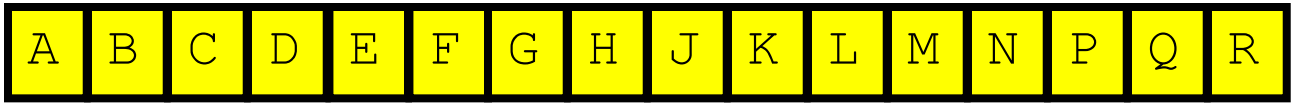


And one last time





Done!



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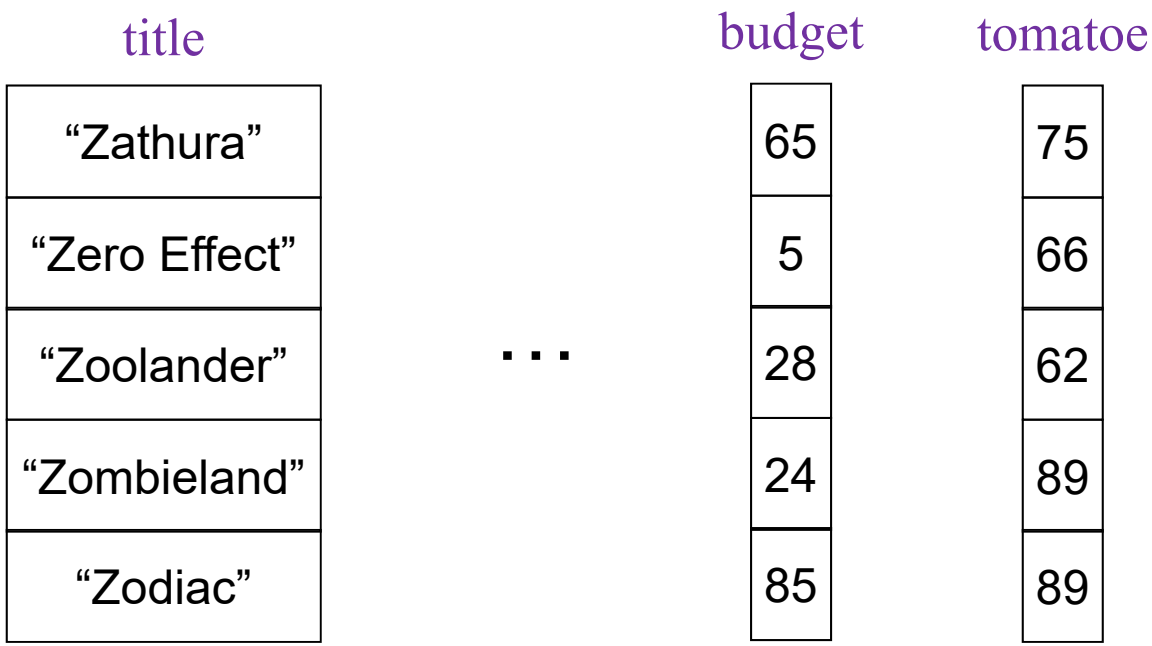
Remember that our movie data set has many columns…

- Shouldn't just sort one list (e.g., list of budget)
- Need to maintain correlation with the other columns



Can define a custom class for our data

Can sort **mList** according to specific attribute, e.g., budget, tomatoe, …. Generally make data easier to work with!