CS111 Introduction to Computer Science
Recitation 11

Exercise 1: Time analysis of everyday tasks

Think of working as a library page who has to shelve returned fiction books in the library.

a. Describe an algorithm that tells how you would do this task. As a group, name 10 novels (title and author) and hand-simulate the algorithm on these books.

b. We want to calculate the cost (in effort) of this task. Assume that you start shelving at the A authors and continue through to the Z authors. Assume there is 1 bookcase of books for each letter of the alphabet containing all authors whose last name starts with that letter. Assume it costs 5 steps per letter of the alphabet to walk past each bookcase on the way to the first letter of the author of the book you are to shelve. For example, it costs 10 steps to get to bookcase C starting at bookcase A, in order to shelve a book by James F. Cooper. With these assumptions, calculate the costs of shelving your selected 10 novels:

- if they are not in any order on the book cart?
- if they are put into sorted order by author's last name on the book cart?

c. Given your estimates above, then can you estimate the *worst case* cost of shelving *n* books:

- if they are not in any order on the book cart?
- if they are put into sorted order by author's last name on the book cart?

Describe the pattern of author last names for the books to be shelved associated with this *worst case* cost.

d. Consider the following algorithm for sorting the books:

1. Put the unsorted books on one shelf, and use a second shelf (initially empty) to hold sorted books.
2. Go through the unsorted books and find the one that is alphabetically first by author's last name (then by author's first name, then by title). Do this by keeping track of the *alphabetically first book you have seen so far*, and comparing it to each successive book.
3. Take the alphabetically first book and put it at the end of the sorted shelf.
4. Repeat steps 2 and 3 until there are no more books left on the unsorted shelf.

How many comparisons between books does it take to sort your list of books? What if there were *n* books instead of 10?

Exercise 2: Project Review

Discuss any questions or concerns you have about the project / current milestone.