This homework covers applications of data structures and fundamentals (sorting, searching, selection, hashing) as well as designing data structures. It is due in class Friday, February 28.

Write your solutions carefully — your work should be neat, readable, and organized.

For the "give an efficient algorithm" problems, focus on leveraging the ADTs, data structures, and fundamental algorithms and techniques (sorting, searching, selection, hashing) discussed in class. (The heading of the section containing the problem gives you a big hint here!)

For the "design a data structure" problems, use the target runtimes stated in the problem to steer you towards a solution — keep in mind what you know about the running time of standard ADT, data structure, array, and linked list operations as well as the tactics discussed in class for improving runtimes (e.g. store instead of search). Your writeup should identify what is stored and how, outline how each operation is carried out, and explain how the desired running time is achieved.

For both algorithm and data structure design problems, key to your writeup is an appropriate level of abstraction — the goal is to express the algorithm with sufficient detail to be understood and to be able to assess its correctness and running time, but not to overwhelm the ideas with details that obscure understanding. Known things can be used as building blocks without having to go into more detail about them. (For example, you don't need to describe or even identify the particular implementation of Queue if you are using a queue — just describe how the enqueue and dequeue operations are used. For the running time, it is known that there is an implementation of Queue where the operations are $\Theta(1)$, so you don't need to identify whether the queue uses an array or a linked list or explain how enqueue and dequeue work.) Review (and revise) your writeup with an eye towards achieving the right level of detail.

See the Policies page on the course website for information about revise-and-resubmit, late work, and academic integrity as it applies to homework.

1. ADM 3-2, page 103. (First make sure you understand the task — why is the answer 12 for the example given?)

2. ADM 3-25, page 104.

3. ADM 4-7, page 141. Also give the running time of your algorithm.

4. ADM 4-41, page 145.

5. ADM 3-11, page 104.

6. ADM 3-18, page 104. Also explain how to modify the operations that need to be modified, don't only identify them.

7. ADM 3-28, page 105.