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Chapter 4. The Mystery of Signs

[The Usual Suspects; the last sentence of the second paragraph to fourth paragraph]

When Watson suggests to Holmes to also exclude the Barrymore couple, Sherlock Holmes responds:

> *No, no, we will preserve them upon our list of suspects.*

This short exchange _____ two things.

First, even though Sherlock Holmes doesn't know anything about data structures, he is using one, since he seems to have kept a list of suspects. A *list* is a simple data structure for storing data items by linking them together. A list provides a distinctive form of accessing and _____ these data items. Second, the list of suspects is not a static entity; it grows and _____ as new suspects are added or when suspects are cleared. Adding, removing, or otherwise changing items in a data structure requires algorithms that generally take more than one step, and it is the runtime of these algorithms that determines how well a specific data structure _____ a particular task.

_____ their simplicity and versatility, lists are probably the most widely used data structure in computer science and beyond. We all use lists on a regular basis in the form of to-do lists, shopping lists, reading lists, wish lists, and all kinds of rankings. The order of the elements in a list matters, and the elements are typically accessed one by one, starting at one end and _____ to the other. Lists are often written down vertically, one element ____ line, with the first element at the top. Computer scientists, however, write list horizontally, presenting the elements from left to right, connected by arrows to indicate the order of the elements. Using this notation, Sherlock Holmes can write down his list of suspects _____:

> Mortimer → Jack → Beryl → Selden → ...

The arrows are called pointers and make the connection between list elements _____, which becomes important when one considers how lists are updated. Assume Sherlock Holmes's suspect list is Mortimer → Beryl and that he wants to add Jack between the two.

[When Order Matters; first to second paragraphs]

As mentioned in Chapter 3, a computation can only be as good as the representation it is working with. Thus Sherlock Holmes and Watson would like the set of suspects to _____ reflect the state of their investigation. In particular, they want the set to be as small as possible (to avoid _____ effort on false leads) but also as large as needed (to avoid having the murderer go undetected). But otherwise the order in which suspects are added to or removed from the set doesn't really matter to them.

For other tasks the order of items in a data representation does matter. Consider, for example, the heirs of the deceased Sir Charles. The difference _____ the first and second in line is the entitlement to a heritage worth one million pounds. This information is not only important for determining who gets rich and who doesn't but also provides Holmes and Watson with clues about _____ motives of their suspects. In fact, the murderer Stapleton is second in line and tries to kill the first heir, Sir Henry. While the succession of heirs matters, the ordering of heirs is not _____ by the time people enter the collection of heirs. For example, when a child is born to the bequeather, it does not become the last in line but takes precedence in the ordering over, say, nephew. A data type in which the ordering of elements is not determined by the time of entry but by some other criterion is called a priority queue. The name _____ that the position of the element in the queue is governed by some priority, such as the relationship to the bequeather in the case of heirs, or the severity of the injury of patient in an emergency room.

Key sentences

- A list is a simple data structure for storing data items by linking them together.
- Since one data type can be implemented by different data structures, the question is which data structure one should choose.
- A data type in which the ordering of elements is not determined by the time of entry but by some other criterion is called a priority queue.