

**2.1b** A dictionary is an associative container: the key is the word, the associated record are the definitions of the words. As a word has multiple definitions, it is a weak ordering.

**2.1d** A spell checker is a simple container—it contains those words that are valid spellings of words and does not contain others. Incidentally, given a word that is not found in the spell checker, there are algorithms for finding the best suggestions for what the author may have desired.

**2.1f** The pre-processor would have to keep a table of defined symbols and their associated values (if any). A look-up table would be most appropriate for a pre-processor, as the pre-processor simply has to check if a symbol is found in the look-up table, and if so, it would be replaced by its value. Incidentally, the pre-processor does not allow recursive definitions—for any look-up, it will apply other definitions to the result, but it will only apply each definition once.

**2.1h** Yes, every linear ordering on a finite number of objects defines a hierarchical ordering on those objects. The first three properties of hierarchical orders are satisfied by any set of objects satisfying linear orders. The smallest object defines the root, and if  $x < y$  and  $y < z$ , then either  $x < y$  or  $y < x$  is also a consequence of the linear ordering. As the three requirements for a partial order are three of the five requirements for a hierarchical order, if a set and the relationship between the objects satisfies the five requirements for a hierarchical order, it must also satisfy the requirements for a partial order.

**2.1j** An implicitly defined relationship is one where the relationship is a consequence of the properties of the object, whereas an explicitly defined relationship is one where the relationship is imposed as an additional property over-and-above the object itself.

For example,  $20123456 < 20999999$  because  $20123456 - 20999999$  is negative. On the other hand, if the Registrar's Office introduced a queuing system for dealing with requests, the order for dealing with two students with these Student ID Numbers would depend not on either the values of the numbers or any other characteristics of the students other than the order in which they arrived at Needle's Hall. That order is an additional property imposed after-the-fact and a property that is