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These problems were given on exams for this course. Some older problems did not make use of generics in Java, but generic implementations are now required in this course.

Problem 1 Write an efficient Java program that reads the words in a file called *input.txt* and prints a list of words that appear 5 or more times in the file. Make sure that capitalization is ignored, for example *Hello* and *hello* should count as the same word. (The program needs no more than 15 lines of code. Solutions that use more than 20 lines of code may be penalized.)

Answer:

Problem 2 Each part of this problem gives some methods. You should answer by naming an ADT or data structure that supplies efficient implementations of the methods, specifying an appropriate implementation strategy, and writing a O -estimate for the run times of the given operations. For example, if the question read:

Methods: insert and remove using LIFO rules.

You could answer:

Stack. Linked node implementation. All operations have time $O(1)$.

Note that standard method names such as push and pop have not been used in this problem. All O -estimates should be specified in terms of n , the number of items in the structure.

- (i) **Methods:** insert and remove, where important items are removed first.
- (ii) **Methods:** insert and remove, where items that have waited the longest are removed first.
- (iii) **Methods:** insert, remove and find, where data items are Comparable.
- (iv) **Methods:** insert, remove and find, where data items are not Comparable, but include a key. (In this case you do not need to specify an implementation or run times.)

Problem 3 A failed internet business needs to wind up their operations. Please advise them on the best data structures to use in implementing programs for the following tasks. Give brief explanations of your advice in each case.

- (a) Maintain a searchable catalogue of company property for sale. The user chooses from a general list of categories, and successively more precise submenus are made available. For example, the a menu might include company cars, computers, and office furniture. If a user selects computers, the next menu could give a choice between PCs or Macs.
- (b) Maintain an inventory of company property. Items will be looked up by serial number and removed from the inventory as they are sold off.
- (c) Keep a record of creditors to be paid off. Important creditors are to be paid off first, and payments are to be made as soon as funds are available.
- (d) Set up a record of employees to lay off. Enter details of long term employees first, but lay off the most recent employees in the record whenever cuts are needed.
- (e) Keep a record of loyal customers, organized by 9 digit zip code. A customer should be able to call in and say: "My zip code is 11367-1234. Give me the names of customers who live nearby, who could help me to lobby the mayor to bail you out."