CS13002 Programming and Data Structures, Spring 2004, Section 3/C

Laboratory Test III **Total points: 30** **April 9, 2004**

For students with odd PC numbers

Implementation of the ADT Aquarium

An *aquarium* is a container (as a glass tank) or an artificial pond in which living aquatic animals are kept and exhibited. In abstract terms, an aquarium is a collection of aquatic animals each identified by the name of its species. Such a collection is different from a set in the sense that there may be many animals of the same species in an aquarium. We usually call such a collection a *multiset*.

In this exercise you are asked to implement an ADT for aquarium that supports the following operations:

newAquarium()	Create a new aquarium without any animals.
add(A,spName,n)	Add n number of animals of species spName to aquarium A.
delete(A,spName,n)	Delete n number of animals of species spName from aquarium A. This operation should fail if A contains less than n animals of species spName.
count(A,spName)	Display the number of animals of species spName in aquarium A.
display(A)	Display the species and numbers of animals in the species present in aquarium A. The list should be sorted by the species names. Only the species with non-zero counts should be displayed.

Output

Your output should report about 50 additions to and 10 deletions from a newly created aquarium. You must display the final content of your aquarium and also some examples of count. Here is a sample:

```
new : New aquarium created.
add "Catfish" 3 : Okay. Current count of "Catfish" is 3.
add "Tiger Barb" 4 : Okay. Current count of "Tiger Barb" is 4.
del "Catfish" 3 : Okay. Current count of "Catfish" is 0.
add "Crab" 1 : Okay. Current count of "Crab" is 1.
del "Tiger Barb" 7 : Error. Current count of "Tiger Barb" is 4.
cnt "Crab" : Current count of "Crab" is 1.
add "Zebra Danio" 5 : Okay. Current count of "Zebra Danio" is 5.
cnt "Cichlid" : Current count of "Cichlid" is 0.
add "Crab" 7 : Okay. Current count of "Crab" is 8.
display:
Crab 8
Tiger Barb 4
Zebra Danio 5
```

Notes:

(1) We leave the choice of data structures and the sorting algorithm to you.

(2) Here are some common species of aquatic animals found in aquariums:

Catfish, Goldfish, Angelfish, Rainbowfish, Cichlid, Rosy Barb, Tiger Barb, Cherry Barb, Zebra Danio, Pearl Danio, Giant Danio, Dwarf Rasbora, Pygmy Rasbora, Spotted Rasbora, Red Rasbora, Harlequin Fish, Killifish, Labyrinth Fish, Platy, Swordtail, Molly, Guppy, Loach, Characin, Silverside, Snail, Shrimp, Crab, Water Frog. (Don't go for adding Piranha to your aquarium. It may bite you!!)

You may use this database to generate a random sequence of add and delete requests. However, if you have time, add a provision to insert new species.

(3) We *encourage* you to go for dynamic memory management and may impose a *small* penalty for statically handling memory. However, it is more important that you complete a fully functional program in the stipulated time. Take ventures, only if you are confident.

(4) We use the term *species* informally to imply the common name of an animal.

CS13002 Programming and Data Structures, Spring 2004, Section 3/C

Laboratory Test III **Total points: 30** **April 9, 2004**

For students with even PC numbers

Implementation of the ADT Aviary

An *aviary* is a place where birds are kept confined, typically for exhibiting purposes. In abstract terms, an aviary is a collection of birds each identified by the name of its species. Such a collection is different from a set in the sense that there may be many birds of the same species in an aviary. We usually call such a collection a *multiset*.

In this exercise you are asked to implement an ADT for aviary that supports the following operations:

newAviary()	Create a new aviary without any birds.
add(A,spName,n)	Add n number of birds of species spName to aviary A.
delete(A,spName,n)	Delete n number of birds of species spName from aviary A. This operation should fail if A contains less than n birds of species spName.
count(A,spName)	Display the number of birds of species spName in aviary A.
display(A)	Display the species and numbers of birds in the species present in aviary A. The list should be sorted by the species names. Only the species with non-zero counts should be displayed.

Output

Your output should report about 50 additions to and 10 deletions from a newly created aviary. You must display the final content of your aviary and also some examples of count. Here is a sample:

```
new : New aviary created.
add "Wren" 3 : Okay. Current count of "Wren" is 3.
add "Blue Jay" 4 : Okay. Current count of "Blue Jay" is 4.
del "Wren" 3 : Okay. Current count of "Wren" is 0.
add "Cockatoo" 1 : Okay. Current count of "Cockatoo" is 1.
del "Blue Jay" 7 : Error. Current count of "Blue Jay" is 4.
cnt "Cockatoo" : Current count of "Cockatoo" is 1.
add "Great Blue Heron",3 : Okay. Current count of "Great Blue Heron" is 3.
cnt "Hornbill" : Current count of "Hornbill" is 0.
add "Cockatoo" 7 : Okay. Current count of "Cockatoo" is 8.
display:
Blue Jay 4
Cockatoo 8
Great Blue Heron 3
```

Notes:

(1) We leave the choice of data structures and the sorting algorithm to you.

(2) Here are some common species of birds found in aviaries:

Wren, Bald Eagle, Golden Eagle, Falcon, Frigatebird, Great Blue Heron, Mockingbird, Nightingale, Robin, Woodpecker, Hummingbird, Blue Jay, Red-shouldered Hawk, Hornbill, Peacock, House Sparrow, Pigeon, Crowned Crane, Sandhill Crane, Mountain Bluebird, Cockatoo, Ground Dove, Gull, Killdeer, Stork, Black Swan, Scarlet Macaw, Blue and Yellow Macaw, Black-billed Magpie, Ostrich, Owl, White Pelican, Teal.

You may use this database to generate a random sequence of add and delete requests. However, if you have time, add a provision to insert new species.

(3) We *encourage* you to go for dynamic memory management and may impose a *small* penalty for statically handling memory. However, it is more important that you complete a fully functional program in the stipulated time. Take ventures, only if you are confident.

(4) We use the term *species* informally to imply the common name of a bird.