CS116

LAB 3

This lab is using mostly material covered in CS115 which is intended as a review. Some new concepts are also introduced.

OBJECTIVE:

The primary new concept in this lab has to do with searching of arrays and implementing the selection sort algorithm.

1. Usage of enum class.
2. Equality of objects.
3. Using a reference of a class as an attribute in another class.
4. Arrays of objects.
5. Vectors.
6. Static and non static members of a class.
7. Using multiple service classes.
8. Sequential search of arrays.
9. Selection Sort algorithm.
10. Binary Search algorithm.
11. Developing a simple algorithm.

Keep in mind that this document is like a specification, you must abide to it regardless if there is another way of doing the problem. In areas where the specification is silent then you can use your discretion.

DUE DATE:

February 24 , 2014. Upload files on Blackboard by 10:00 p.m.

GRADE POINTS: 2 points towards final grade.

Create a separate folder for each task. When done with all tasks, place the individual task folders into a folder which named with yourname_Lab3 and zip it. Upload to assignment folder Lab3 on Blackboard. Notice that in some cases, files have to be copied from one task folder to another in order to make each task independent.

Use EditPlus or Notepad++ or equivalent editor to create source code. Do not use eclipse.

LAB DESCRIPTION:

In this Lab we are going to have 3 normal classes (one being the client class and the other two being service classes) and two enumerations. The client class would have to use both of the service classes.

Task 1 (1.0 point)

1. GET THE TASK ONE CLASSES FROM LAB 2

You must use your own solution to Lab 2 Task 1 and do NOT use the posted solution if you were able to successfully do it. You will need the Rod.java and the MaterialCategories.java classes

Please do not use the solution files! If your Lab 2 solution had problems, you should correct them based on the TA's comments and proceed to use your own solution in this Lab. (you could look up the posted solution and make corrections on your own **without** using the same identifier names or even the exact lines of code).

USING THE IDENTICAL FILES AS THE ONES PROVIDED IN THE LAB 2 SOLUTION, COULD COST YOU POINTS OFF.
The idea is to have you understand your own errors and correct them.

- Amend the class Rod to include one more attribute of type int which represents temperature. Add accessor and mutator methods for this attribute and also added to the toString method "The temperature is:"+..
- Default temperature is 0.
- Include the temperature attribute as the first argument in the non default constructor
- Amend the ,method calculateExpansion so that there is only one argument of double type representing the coefficient of thermal expansion.

2. CREATE ADDITIONAL NEW SERVICE CLASSES.
- Create a second service class called ReadData which also resides in the package firstname .lastname when compiled (same package as Rod and MaterialCategories.
- It has two instance variables which are arrays of type double. They would be used to store the coefficient and young's modulus numbers when the text file is read. Make sure that they are declared public.
- This class has a method called vectorData. It takes as an argumengt a String that represents the name of the text file **coefficients.txt** (data for that file is shown below). It reads the data line by line off the text file, tokenizes it and creates objects of Rod which it stores into a vector data structure. It saves the coefficients of thermal expansion into an array which is an instance variable of this class, and the Young's modulus numbers into another array which is also an

instance variable of this class (keep in mind that these two arrays need to be instantiated based on the size of the data!). It returns the vector.

public   Vector   vectorData(String filename).

- There is also a method called sortVector. The method accepts as argument a Vector of non sorted Rod objects. **It sorts the Rod objects according to the tempearature from largest to smallest**. It returns the sorted vector.

  public Vector sortVector(Vector v).

- There is also a method called searchVector. It takes as argument a sorted Vector according to Temperature value of eache Rod object, and a int value that serves as a search key for a temperture value. It returns the index of the Vector at which the Rod object with the key temperature is stored or -1 if the force value is not found. **It uses Binary Search algorithm.**

  public int searchVector(Vector sv, int key)

- Compile this class.
  NOTE: When you compile disregard the following message, your file is compiled fine:

  C:\CS116\SPRING2014\Labs\Lab3\Lab3Solution>javac -d . ReadData.java
  Note: ReadData.java uses unchecked or unsafe operations.
  Note: Recompile with -Xlint:unchecked for details.

Task 2 (1.0 Point)

Copy all the classes from Task1 into this new folder Task2, including the compiled classes in their corresponding packages.

Client class RodClient:
1. Create the class RodClient to be placed in package firstname .
   Notice that it is not the same code as the original in Lab 2. Therefore it should be a brand new File.
   The main method requires the data value of the text file with the data captured command line in order to continue with the program.
   - It invokes the method vectorData from the ReadData class and captures the data structure.
   - It captures the two arrays instance variables from ReadData (the coefficients array and the young's modulus array).
   - It invokes the method sortVector from the ReadData class and passes it the unsorted vector. It captures the returned vector.
   - It displays the values of the attributes of each Rod object in the sorted vector including the expansion for each rod object in the sorted vector and the required force for each

rod object in the sorted vector. Notice that you should much the same output values as in lab 2! You can double check that by comparing objects according to their id values, since in lab 2 the data is outputted sequentially from id=1 ,2,3,4,5,6 etc. (but in lab 3 they are sorted by temperature).

- It searches the sorted vector for the temperature value 89. It uses the returned value to display the attributes of the Rod object if found or a statement that it was not found.
- It then searches the sorted vector for the temperature value of 156. It uses the returned value to display the attributes of the Rod object if found or a statement that it was not found.

2. A text file with the data needed for this program should be created using Notepad (or download the text file from the course's web site):
Notice that the temperature is the last number after Young's modulus number!
The sequence of data is : category, name of material, cross sectional area, coefficient of thermal expansion, Young's modulus, temperature. The file is also available on the course's web site.

AluminumBased,Aluminum,1.25,2.5,0.000013,10000000,23
Metal,Brass,2.25,25.0, 0.00001,13000000,40
Metal,Copper,2.25,25.0,0.0000094,16000000,37
Cellulose,CelluloseAcetate,2.5,5.0,0.000130,20000000,89
Metal,Lead,2.25,25.0, 0.000017,2300000,100
Glass,Hard,0.4,3.0,0.0000059,90000000,150
Metal,Steel,2.25, 25.0,0.0000067,29000000,10
Metal,Iron,2.25,25.0, 0.0000067,13000000,26
AluminumBased,AlumAlloy,1.25,2.5,0.0000023,10200000,56
Cellulose,CelluloseNitrate,2.5,5.0,0.000100,50000000,90
Glass,Pyrex,0.4,3.0,0.000004,17000000,36
AluminumBased,Aluminum,0.25,3.5,0.000013,10000000,22
Metal,Lead,1.25,5.0, 0.000017,2300000,35
Metal,Iron,0.25,25.0, 0.0000067,13000000,56
Glass,Pyrex,1.4,3.0,0.000004,17000000,200
Cellulose,CelluloseAcetate,6.5,25.0,0.000130,20000000,250

- See the sample output for details on the output format.

Compile all classes in this task
Interpret the program!

Sample Output based on current text file data

C:\CS116\SPRING2014\Labs\Lab3\Lab3Solution>java firstname.RodClient coefficients.txt
The category is: Cellulose The name of the material is CelluloseAcetate The length is 25.0 The cross area is 6.5 The temperature is: 250 the object id is 16
The expansion is: 0.8125
The force required is: 4225000.0

The category is: Glass The name of the material is Pyrex The length is 3.0 The cross area is 1.4 The temperature is: 200 the object id is 15
The expansion is: 0.0024
The force required is: 19040.0

The category is: Glass The name of the material is Hard The length is 3.0 The cross area is 0.4 The temperature is: 150 the object id is 6
The expansion is: 0.0027
The force required is: 32400.0

The category is: Metal The name of the material is Lead The length is 25.0 The cross area is 2.25 The temperature is: 100 the object id is 5
The expansion is: 0.0425
The force required is: 8797.5

The category is: Cellulose The name of the material is CelluloseNitrate The length is 5.0 The cross area is 2.5 The temperature is: 90 the object id is 10
The expansion is: 0.045
The force required is: 1125000.0

The category is: Cellulose The name of the material is CelluloseAcetate The length is 5.0 The cross area is 2.5 The temperature is: 89 the object id is 4
The expansion is: 0.0578
The force required is: 578000.0

The category is: AluminumBased The name of the material is AlumAlloy The length is 2.5 The cross area is 1.25 The temperature is: 56 the object id is 9
The expansion is: 3.0E-4
The force required is: 1530.0

The category is: Metal The name of the material is Iron The length is 25.0 The cross area is 0.25 The temperature is: 56 the object id is 14
The expansion is: 0.0094
The force required is: 1222.0

The category is: Metal The name of the material is Brass The length is 25.0 The cross area is 2.25 The temperature is: 40 the object id is 2

The expansion is: 0.01
The force required is: 11700.0

The category is: Metal The name of the material is Copper The length is 25.0 The cross area is 2.25 The temperature is: 37 the object id is 3
The expansion is: 0.0087
The force required is: 12528.0

The category is: Glass The name of the material is Pyrex The length is 3.0 The cross area is 0.4 The temperature is: 36 the object id is 11
The expansion is: 4.0E-4
The force required is: 906.67

The category is: Metal The name of the material is Lead The length is 5.0 The cross area is 1.25 The temperature is: 35 the object id is 13
The expansion is: 0.003
The force required is: 1725.0

The category is: Metal The name of the material is Iron The length is 25.0 The cross area is 2.25 The temperature is: 26 the object id is 8
The expansion is: 0.0044
The force required is: 5148.0

The category is: AluminumBased The name of the material is Aluminum The length is 2.5 The cross area is 1.25 The temperature is: 23 the object id is 1

The expansion is: 7.0E-4
The force required is: 3500.0

The category is: AluminumBased The name of the material is Aluminum The length is 3.5 The cross area is 0.25 The temperature is: 22 the object id is 12
The expansion is: 0.001
The force required is: 714.29

The category is: Metal The name of the material is Steel The length is 25.0 The cross area is 2.25 The temperature is: 10 the object id is 7
The expansion is: 0.0017
The force required is: 4437.0

//FIND TEMERATURE OUTPUT

The object was found and it is: The category is: Cellulose The name of the material is CelluloseAcetate The length is 5.0 The cross area is 2.5 The temperature is: 89 the object id is 4

Temperature 156 value was not found

Submission instructions

- In your submission you must include
    a. The answers to the questions if any.
    b. The source code files and the compiled files (the package) from Task 1 in the correct package.
    c. The source code files and the compiled files (the package) required for Task 2 in the proper package.

- Zip all files and name the zip file using your first name followed by your last name followed by lab1.
    i.e. George_KayLab3.zip

- Upload the file on Blackboard by 10:00 p.m. on the due date (Blackboard time stamps automatically) in assignment folder labeled Lab3.

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