CS116

LAB 9

Lab 9 is due on 4/25 on Blackboard time stamped by 10:00 p.m. .

This lab is worth 5 points.

Objectives:

1. Recursive methods

Task 1 (2.5 point)

1. Fibonacci numbers is a sequence of numbers where every number is the sum of the previous two numbers. The first number is zero the next number is 1 the third number is 1 (0+1), the fourth number is 2 (1+1), the fifth number is 3 (1+2) and so on (5, 8, 13, 21…..). The mathematical representation is:

$$F_n = \begin{cases} 0 & \text{if } n = 0; \\ 1 & \text{if } n = 1; \\ F_{n-1} + F_{n-2} & \text{if } n > 1. \end{cases}$$

Write a recursive method that will produce Fibonacci numbers. Call the recursive method Fibonacci (which exist in class Fibonacci). Output the values of the sequence in the main method of the class by using a counter that counts up from zero to 10 (inclusive). The Fibonacci method receives a long data type called number as argument. Output the counter value and the sequence number produced for that counter value. Think of the base case and the generalized case.

i.e.

System.out.printf("The Fibonacci of:"+ counter+" "+"is"+" "+ fibonacci(counter));

The output should be as an example : The Fibonacci of 3 is 2.

C:\CS116\SPRING2010\Labs\Lab7\Lab7Solution\Task1>java Fibonacci
Fibonacci of 0 is: 0
Fibonacci of 1 is: 1
Fibonacci of 2 is: 1
Fibonacci of 3 is: 2

Fibonacci of 4 is: 3
Fibonacci of 5 is: 5
Fibonacci of 6 is: 8
Fibonacci of 7 is: 13
Fibonacci of 8 is: 21
Fibonacci of 9 is: 34
Fibonacci of 10 is: 55

2. Write a class called Combinations. Implement the combinations method **in a recursive way** from the example in the lecture. The main method of the class calls the combinations method. The user is asked to enter the two numbers (n and p) and the program calculates and outputs the number of combinations for that pair of numbers. The program loops and continues to ask for a pair of numbers until the user enters -1 in which case the program terminates.

    - The combinations method should take two int numbers as arguments (n and p where n>=p) and return an int number that represents the possible number of combinations.
    - Run the program for test inputs (10, 2) and (4, 2), (10, 10) and notice the results.

3. Repeat the above program with a new class CombinationsFormula. This time use the formula for combinations in the method combinations(n,p). See Lecture 13 presentation for the formula. Implement the formula using the recursive method for factorial.

    - You should have a main method .
    - A method called combinations which uses a method called factorial.
    - A method called factorial that calculates the factorial of a number.
    - Run the program for test inputs (10,2) and (4,2), (10,10) and make sure that they are equal to the results in step 1.
    - **OUTPUT**
    - C:\CS116\SPRING2011\Labs\Lab7\Lab7\Lab7Solution\Task2>java Combinations
    - Please enter the combination numbers
    - 10 2
    - 45

- Please enter the combination numbers
- 4 2
- 6
- Please enter the combination numbers
- 10 10
- 1
- Please enter the combination numbers
-
- C:\CS116\SPRING2011\Labs\Lab7\Lab7\Lab7Solution\Task2>java CombinationsFormula
- Please enter the combination numbers
- 10 2
- 45
- Please enter the combination numbers
- 4 2
- 6
- Please enter the combination numbers
- 10 10
- 1
- Please enter the combination numbers
-

Task 2 (2.5- points)

Using a recursive version of binary search

1. Using the solution to lab program from the past , called OldLab 4.zip make the following changes. The file is available on the course's web site.

2. Make sure that in the class Vehicle there is a set method for the static variable that counts the vehicle IDs (ie. static int vehicleID).

3. In the class Data

a. Revise the binary search method: public int arrayBinarySearch(Vehicle [] sortedarray, double key) to public String binarySearch(Vehicle [] sortedarray, double key, int start, int end) where the key is the **value** . String is the name of the vehicle's owner (or the message: Object Not Found). Code the method **recursively.**

b. Revise the binary search method: public int binarySearchVector(Vector veh, double key) to public String binarySearchVector(Vector veh, double key, int start , int end) similarly to the array version. Code it **recursively.**

c. Revise the createArray method so that the static variable vehicleID of a Vehicle is reset to 100 (since we are doing the vector first and then the array, it would continue advancing the ID if we don't reset it). You need to call the setVehicleID method to reset it to 100.

d. Revise the selectionSort method so that:

i. Accepts as an argument an array of Vehicle types to be sorted.

ii. Sorts the Vehicle objects according to price (called value in the solution) from largest to smallest.

e. Make sure that in both the arrayOfObjects and vectorOfVehicles methods, the method calculateValue is invoked for each vehicle object (so that the value attribute is set).

4. In the class NewVehicleClient:

a. Modify the call : int i=aov.vectorBinarySearch(sortedvect, 7.0);

so that it complies with the new arguments of the binarySearch method. Search for a vehicle value of 48000.

Modify the code so that the name of the owner is displayed if found ("The name of the owner of the 48000 value vehicle is:--) or if not found the warning message returned by the method is displayed instead of the name.

NOTE: You can comment out any other code from Lab 4 if not needed FOR THIS TASK IN THIS LAB. i.e code related to finding and displaying vehicles according to velocity.

b. Add code in class NewVehicleClient: repeat everything that was done with respect to using a vector, but this time capture the array version, sort the array (according to value)

and do a binary search(using the array version) for the value (38000) using the proper binarySearch method (the one that has been modified to a recursive approach). Repeat all outputs as in the vector case. Make sure to include a statement before each version of the data is run like:

System.out.println("I am using an array."); or

System.out.println("I am using a vector.");

5. Recompile and run the program. Disregard the compiler message:

   Note: Data.java uses unchecked or unsafe operations.

   Note: Recompile with -Xlint:unchecked for details.

5. Before you run the program make sure that in the text file there are no spaces between the coma and the next String!

6. **Run the program and make sure that the output is the same in both cases. In other words the output generated by using the array should be identical to the output generated by using a vector.**

Sample Output

C:\CS116\FALL2012\Labs\Lab9\Lab9Solution\Task2\Lab4Solution\TASK1F2012>java ClientClass.NewVehicleClient

The file has 10lines

I am creating the non sorted array. Vehicle with id: 101 has a velocity 5.08 The distance covered is: 109.12 the value is 25000.0

I am creating the non sorted array. Vehicle with id: 102 has a velocity 8.92 The distance covered is: 114.88 the value is 25000.0

I am creating the non sorted array. Vehicle with id: 103 has a velocity 16.48 The distance covered is: 117.48 the value is 48000.0

I am creating the non sorted array. Vehicle with id: 104 has a velocity 41.0 The distance covered is: 205.0 the value is 59000.0

I am creating the non sorted array. Vehicle with id: 105 has a velocity 95.5 The distance covered is: 389.5 the value is 75000.0

I am creating the non sorted array. Vehicle with id: 106 has a velocity 15.0 The distance covered is: 156.0 the value is 25000.0

I am creating the non sorted array. Vehicle with id: 107 has a velocity 20.08 The distance covered is: 131.62 the value is 48000.0

I am creating the non sorted array. Vehicle with id: 108 has a velocity 41.5 The distance covered is: 291.25 the value is 48000.0

I am creating the non sorted array. Vehicle with id: 109 has a velocity 19.0 The distance covered is: 150.0 the value is 38000.0

I am creating the non sorted array. Vehicle with id: 110 has a velocity 6.5 The distance covered is: 103.75 the value is 48000.0

NON SORTED ARRAY OUTPUT-ACCELERATIONS AS LISTED IN TEXT FILE

The vehicle ID is: 101 The name of the owner is: George The acceleration is: 1.7m/secThe velocity is 5.08 The dealership is: GlenEllynChevy The engine Size is: Litters_1Point5 The traveling time is; 3 The value is: 25000.0

The vehicle ID is: 102 The name of the owner is: Maria The acceleration is: 2.2m/secThe velocity is 8.92 The dealership is: ChicagoFord The engine Size is: Litters_2Point4 The traveling time is; 3 The value is: 25000.0

The vehicle ID is: 103 The name of the owner is: Melina The acceleration is: 4.3m/secThe velocity is 16.48 The dealership is: WilmetteChrysler The engine Size is: Litters_3Point0 The traveling time is; 2 The value is: 48000.0

The vehicle ID is: 104 The name of the owner is: John The acceleration is: 4.0m/secThe velocity is 41.0 The dealership is: SouthMercedes The engine Size is: Litters_4Point0 The traveling time is; 5 The value is: 59000.0

The vehicle ID is: 105 The name of the owner is: Henry The acceleration is: 6.3m/secThe velocity is 95.5 The dealership is: WestBMW The engine Size is: Litters_6Point0 The traveling time is; 6 The value is: 75000.0

The vehicle ID is: 106 The name of the owner is: Stephania The acceleration is: 2.5m/secThe velocity is 15.0 The dealership is: ChicagoFord The engine Size is: Litters_1Point5 The traveling time is; 7 The value is: 25000.0

The vehicle ID is: 107 The name of the owner is: Helen The acceleration is: 5.3m/secThe velocity is 20.08 The dealership is: WilmetteChrysler The engine Size is: Litters_2Point4 The traveling time is; 3 The value is: 48000.0

The vehicle ID is: 108 The name of the owner is: Robert The acceleration is: 2.5m/secThe velocity is 41.5 The dealership is: GlenEllynChevy The engine Size is: Litters_3Point0 The traveling time is; 9 The value is: 48000.0

The vehicle ID is: 109 The name of the owner is: Clint The acceleration is: 1.8m/secThe velocity is 19.0 The dealership is: WestBMW The engine Size is: Litters_4Point0 The traveling time is; 5 The value is: 38000.0

The vehicle ID is: 110 The name of the owner is: Maria The acceleration is: 2.2m/secThe velocity is 6.5 The dealership is: ChicagoFord The engine Size is: Litters_6Point0 The traveling time is; 1 The value is: 48000.0

OUTPUT OF SORTED ACCELERATION VALUES-ADJUSTED ACCELERATIONS

The vehicle ID is: 102 The name of the owner is: Maria The acceleration is: 2.64m/secThe velocity is 8.92 The dealership is: ChicagoFord The engine Si
ze is: Litters_2Point4 The traveling time is; 3 The value is: 25000.0
The vehicle ID is: 106 The name of the owner is: Stephania The acceleration is: 2.0m/secThe velocity is 15.0 The dealership is: ChicagoFord The engine
Size is: Litters_1Point5 The traveling time is; 7 The value is: 25000.0
The vehicle ID is: 101 The name of the owner is: George The acceleration is: 1.36m/secThe velocity is 5.08 The dealership is: GlenEllynChevy The engin
e Size is: Litters_1Point5 The traveling time is; 3 The value is: 25000.0
The vehicle ID is: 109 The name of the owner is: Clint The acceleration is: 3.6m/secThe velocity is 19.0 The dealership is: WestBMW The engine Size is
: Litters_4Point0 The traveling time is; 5 The value is: 38000.0
The vehicle ID is: 110 The name of the owner is: Maria The acceleration is: 5.5m/secThe velocity is 6.5 The dealership is: ChicagoFord The engine Size
is: Litters_6Point0 The traveling time is; 1 The value is: 48000.0
The vehicle ID is: 107 The name of the owner is: Helen The acceleration is: 6.36m/secThe velocity is 20.08 The dealership is: WilmetteChrysler The eng
ine Size is: Litters_2Point4 The traveling time is; 3 The value is: 48000.0
The vehicle ID is: 108 The name of the owner is: Robert The acceleration is: 4.5m/secThe velocity is 41.5 The dealership is: GlenEllynChevy The engine
Size is: Litters_3Point0 The traveling time is; 9 The value is: 48000.0
The vehicle ID is: 103 The name of the owner is: Melina The acceleration is: 7.74m/secThe velocity is 16.48 The dealership is: WilmetteChrysler The en
gine Size is: Litters_3Point0 The traveling time is; 2 The value is: 48000.0
The vehicle ID is: 104 The name of the owner is: John The acceleration is: 8.0m/secThe velocity is 41.0 The dealership is: SouthMercedes The engine Si
ze is: Litters_4Point0 The traveling time is; 5 The value is: 59000.0
The vehicle ID is: 105 The name of the owner is: Henry The acceleration is: 15.75m/secThe velocity is 95.5 The dealership is: WestBMW The engine Size
is: Litters_6Point0 The traveling time is; 6 The value is: 75000.0
I AM USING THE ARRAY

The name of the owner of the 38000 value vehicle is: Clint
NON SORTED VECTOR VALUES

I am creating the non sorted Vector. Vehicle with id: 101 has a velocity 5.08 The distance covered is: 10.12
I am creating the non sorted Vector. Vehicle with id: 102 has a velocity 8.92 The distance covered is: 15.88
I am creating the non sorted Vector. Vehicle with id: 103 has a velocity 16.48 The distance covered is: 18.48

I am creating the non sorted Vector. Vehicle with id: 104 has a velocity 41.0 The distance covered is: 106.0

I am creating the non sorted Vector. Vehicle with id: 105 has a velocity 95.5 The distance covered is: 290.5

I am creating the non sorted Vector. Vehicle with id: 106 has a velocity 15.0 The distance covered is: 57.0

I am creating the non sorted Vector. Vehicle with id: 107 has a velocity 20.08 The distance covered is: 32.62

I am creating the non sorted Vector. Vehicle with id: 108 has a velocity 41.5 The distance covered is: 192.25

I am creating the non sorted Vector. Vehicle with id: 109 has a velocity 19.0 The distance covered is: 51.0

I am creating the non sorted Vector. Vehicle with id: 110 has a velocity 6.5 The distance covered is: 4.75

The vehicle ID is: 101 The name of the owner is: George The acceleration is: 1.7m/secThe velocity is 5.08 The dealership is: GlenEllynChevy The engine

Size is: Litters_1Point5 The traveling time is; 3 The value is: 25000.0

The vehicle ID is: 102 The name of the owner is: Maria The acceleration is: 2.2m/secThe velocity is 8.92 The dealership is: ChicagoFord The engine Siz

e is: Litters_2Point4 The traveling time is; 3 The value is: 25000.0

The vehicle ID is: 103 The name of the owner is: Melina The acceleration is: 4.3m/secThe velocity is 16.48 The dealership is: WilmetteChrysler The eng

ine Size is: Litters_3Point0 The traveling time is; 2 The value is: 48000.0

The vehicle ID is: 104 The name of the owner is: John The acceleration is: 4.0m/secThe velocity is 41.0 The dealership is: SouthMercedes The engine Si

ze is: Litters_4Point0 The traveling time is; 5 The value is: 59000.0

The vehicle ID is: 105 The name of the owner is: Henry The acceleration is: 6.3m/secThe velocity is 95.5 The dealership is: WestBMW The engine Size is

: Litters_6Point0 The traveling time is; 6 The value is: 75000.0

The vehicle ID is: 106 The name of the owner is: Stephania The acceleration is: 2.5m/secThe velocity is 15.0 The dealership is: ChicagoFord The engine

Size is: Litters_1Point5 The traveling time is; 7 The value is: 25000.0

The vehicle ID is: 107 The name of the owner is: Helen The acceleration is: 5.3m/secThe velocity is 20.08 The dealership is: WilmetteChrysler The engi

ne Size is: Litters_2Point4 The traveling time is; 3 The value is: 48000.0

The vehicle ID is: 108 The name of the owner is: Robert The acceleration is: 2.5m/secThe velocity is 41.5 The dealership is: GlenEllynChevy The engine

Size is: Litters_3Point0 The traveling time is; 9 The value is: 48000.0

The vehicle ID is: 109 The name of the owner is: Clint The acceleration is: 1.8m/secThe velocity is 19.0 The dealership is: WestBMW The engine Size is

: Litters_4Point0 The traveling time is; 5 The value is: 38000.0

The vehicle ID is: 110 The name of the owner is: Maria The acceleration is: 2.2m/secThe velocity is 6.5 The dealership is: ChicagoFord The engine Size
is: Litters_6Point0 The traveling time is; 1 The value is: 48000.0
SORTED VECTOR VALUES

The vehicle ID is: 101 The name of the owner is: George The acceleration is: 1.7m/secThe velocity is 5.08 The dealership is: GlenEllynChevy The engine
Size is: Litters_1Point5 The traveling time is; 3 The value is: 25000.0
The vehicle ID is: 110 The name of the owner is: Maria The acceleration is: 2.2m/secThe velocity is 6.5 The dealership is: ChicagoFord The engine Size
is: Litters_6Point0 The traveling time is; 1 The value is: 48000.0
The vehicle ID is: 102 The name of the owner is: Maria The acceleration is: 2.2m/secThe velocity is 8.92 The dealership is: ChicagoFord The engine Siz
e is: Litters_2Point4 The traveling time is; 3 The value is: 25000.0
The vehicle ID is: 106 The name of the owner is: Stephania The acceleration is: 2.5m/secThe velocity is 15.0 The dealership is: ChicagoFord The engine
Size is: Litters_1Point5 The traveling time is; 7 The value is: 25000.0
The vehicle ID is: 103 The name of the owner is: Melina The acceleration is: 4.3m/secThe velocity is 16.48 The dealership is: WilmetteChrysler The eng
ine Size is: Litters_3Point0 The traveling time is; 2 The value is: 48000.0
The vehicle ID is: 109 The name of the owner is: Clint The acceleration is: 1.8m/secThe velocity is 19.0 The dealership is: WestBMW The engine Size is
: Litters_4Point0 The traveling time is; 5 The value is: 38000.0
The vehicle ID is: 107 The name of the owner is: Helen The acceleration is: 5.3m/secThe velocity is 20.08 The dealership is: WilmetteChrysler The engi
ne Size is: Litters_2Point4 The traveling time is; 3 The value is: 48000.0
The vehicle ID is: 104 The name of the owner is: John The acceleration is: 4.0m/secThe velocity is 41.0 The dealership is: SouthMercedes The engine Si
ze is: Litters_4Point0 The traveling time is; 5 The value is: 59000.0
The vehicle ID is: 108 The name of the owner is: Robert The acceleration is: 2.5m/secThe velocity is 41.5 The dealership is: GlenEllynChevy The engine
Size is: Litters_3Point0 The traveling time is; 9 The value is: 48000.0
The vehicle ID is: 105 The name of the owner is: Henry The acceleration is: 6.3m/secThe velocity is 95.5 The dealership is: WestBMW The engine Size is
: Litters_6Point0 The traveling time is; 6 The value is: 75000.0
I AM USING A VECTOR

The name of the owner of the 48000 value vehicle is: Melina

Submission instructions

- Zip all files and name the zip file using your first name followed by your last name followed by lab9.

  i.e. George_KayLab9.zip
- Upload the file on Blackboard by 10:00 p.m. on the due date (Blackboard time stamps automatically) under Assignment Lab 9.