Pimpri Chinchwad College of Engineering
Computer Laboratory - IV

Assignment No - B2

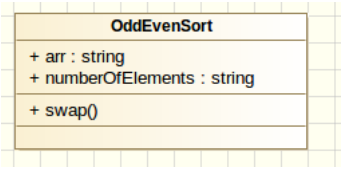
AIM: A Web application for Concurrent implementation of ODD-EVEN SORT is to be designed using Real time Object Oriented Modeling(ROOM). Give the necessary design diagrams and write the test cases for the white box testing. Draw Concurrent collaboration Diagrams.

OBJECTIVE:

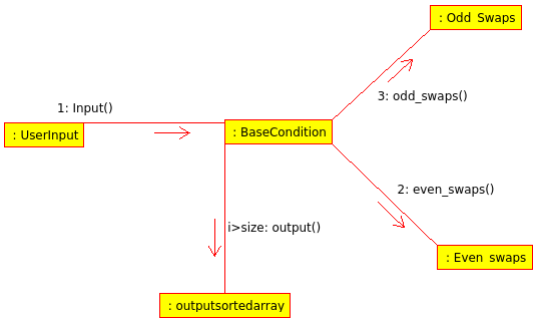
- To implement the Odd-Even Sort algorithm using C++.
- To test the resultant application using White-box testing techniques.

UML diagrams :

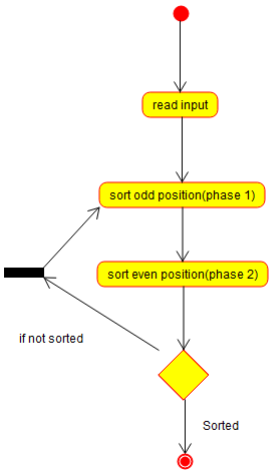
- **Class diagram :**



- **Collaboration Diagram :**



- **Flowchart :**



MATHEMATICAL MODEL:

S={s,e,X,Y,Fme,DD,NDD}

s=Initial State

The program does not contain any previously initialized values

e=End State

Sorting is performed using the mentioned algorithm, which is Odd-even sort. After passing the values to the program, the appropriate function calculates the output values which are in sorted order.

X=Input given
The input given to the app are random numbers which are to be sorted.

Y=Output obtained
The output of the app is the resultant sorted array after sorting operations using the Odd-Even sort.

Fme=Function/Algorithm
The algorithm consists of functions various condition statements which check whether the give index of the array is even, or odd. Appropriate swapping takes place in either of the cases.

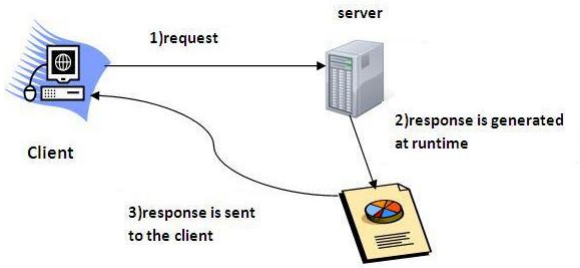
DD=Deterministic data
There is no deterministic data in the application.

NDD=Non-deterministic data
The output will be dependent upon what input the user provides.

Theory:

- **Servlet:** Servlet can be described in many ways, depending on the context.
  - Servlet is a technology i.e. used to create web application.
  - Servlet is an API that provides many interfaces and classes including documentations.
  - Servlet is an interface that must be implemented for creating any servlet.
  - Servlet is a class that extend the capabilities of the servers and respond to the incoming request. It can respond to any type of requests.
  - Servlet is a web component that is deployed on the server to create dynamic web page.

  A Java servlet is a Java program that extends the capabilities of a



server. Although servlets can respond to any types of requests, they most commonly implement applications hosted on Web servers.

- **Odd-Even sort:** An oddeven sort or oddeven transposition sort (also known as brick sort) is a relatively simple sorting algorithm, developed originally for use on parallel processors with local interconnections. It is a comparison sort related to bubble sort, with which it shares many characteristics. It functions by comparing all odd/even indexed pairs of adjacent elements in the list and, if a pair is in the wrong order (the first is larger than the second) the elements are switched. The next step repeats this for even/odd indexed pairs (of adjacent elements). Then it alternates between odd/even and even/odd steps until the list is sorted.

- **Sorting on processor arrays:**
  On parallel processors, with one value per processor and only local left-right neighbor connections, the processors all concurrently do a compareexchange operation with their neighbors, alternating between odd-even and evenodd pairings.

Testing:

- **White-box testing:**
  White-box testing (also known as clear box testing, glass box testing, transparent box testing, and structural testing) is a method of testing software that tests internal structures or workings of an application, as opposed to its functionality (i.e. black-box testing).

  In white-box testing an internal perspective of the system, as well as programming skills, are used to design test cases. The tester chooses inputs to exercise paths through the code and determine the appropriate outputs. This is analogous to testing nodes in a circuit, e.g. in-circuit testing (ICT). White-box testing can be applied at the unit, integration and system levels of the software testing process.

White-box test design techniques include the following code coverage criteria:

- Control flow testing
- Data flow testing
- Branch testing
- Statement coverage
- Decision coverage
- Modified condition/decision coverage
- Prime path testing
- Path testing

- **Test cases using white box testing :**

Test Case ID	Objective	Test Description	Test Data	Expected output	Actual output	Result	Method
1	Check input elements	Input is in random order	One random series of elements	Series should be sorted	Series is sorted	Pass	white box code testing
2	Check If element is even	Elements are checked from the even position of given series	series of elements	Even position elements must be sorted	even position elements are sorted	Pass	White box condition testing
3	Check If element is odd	Elements are checked from the odd position of given series	series of elements	Odd position elements must be sorted	Odd position elements are sorted	Pass	White box condition testing
4	Check exception for input	Array input out of bounds	series of elements greater than the array size	Throws Array index out of bound exception	Throws array index out of bound exception	Pass	Black box testing

White box testing:

1. No of Loops : 3
2. No of Conditions : 10
3. No of Plain Statements :6
4. Total Lines : 65

Enter the number of elements 5
Hence size = 5
Enter the elements 8 1 4 3 9

Testing Loops for Sorting
Looping Variables i,j,k
k - Outer For Loop
i - Inner kj - Inner k
Initially k = 0

Iteration No 1
k=0
k%2==0 is True Hence Swap Even Positions
if(i!=arr.length-1) is True
if(arr[i]>arr[i+1]) is True in case of(a[0],a[1]),(a[2],a[3])
Inner Loop Ends Successfully when i >size
1 8 3 4 9

Iteration No 2
k=1
k%2==0 is False Hence Swap Odd Positions
if(i!=arr.length-1) is True
if(arr[i] >arr[i+1]) is True in case of(a[1],a[2])
Inner Loop Ends Successfully when j >size
1 3 8 4 9

Iteration No 3
k=2
k%2==0 is True Hence Swap Even Positions
if(i!=arr.length-1) is True
if(arr[i] >arr[i+1]) is True in case of(a[2],a[3])
Inner Loop Ends Successfully when i >size
1 3 4 8 9

Iteration No 4
k=3
k%2==0 is False Hence Swap Odd Positions
if(i!=arr.length-1) is True
if(arr[i] >arr[i+1]) is False In case of All
Inner Loop Ends Successfully when j >size

1 3 4 8 9

Iteration No 5
k=4
k%2==0 is True Hence Swap Even Positions
if(i!=arr.length-1) is True
if(arr[i] >arr[i+1]) is False In case of All
Inner Loop Ends Successfully when i >size
1 3 4 8 9

Iteration 6
k=5
k¡size is False Hence Sorting Loops are completely executed.
Tested Completely

Thus All Paths Are Tested Successfully and Code Coverage is 100% as each line is executed atleast once.

- **Real-Time Object-Oriented Modeling (ROOM)** Model real time systems based on timeliness, dynamic internal structure, reactiveness, concurrency and distribution, using the ROOM notation.
  ROOM is an object-oriented methodology for real-time systems developed originally at Bell-Northern Research. ROOM is based upon a principle of using the same model for all phases of the development process. ROOM models are composed of actors which communicate with each other by sending messages along protocols. Actors may be hierarchically decomposed, and may have behaviors described by ROOM charts, a variant of Harel's state charts. Descriptions of actors, protocols, and behaviors can all be reused through inheritance.

- **ROOM Diagram Software Features**

- Chart Templates

- Symbol Gallery

- Drag and Drop Interface

- Grids & Guides

- Snap-to

- Change Existing Diagram Shapes
- Automatic Spacing & Alignment
- Multiple Connector Points
- Change Connector Path
- Connector Labels
- Add Connector Points to Symbols
- Junction Jogs
- Multiple Pages
- Add Hyperlinks
- Grouping Shapes
- Expandable Canvas

Conclusion:
We have studied and implemented an Odd-Even sort algorithm in C++, and applied White-box testing techniques.

Roll No.	**Name of Student**	**Date of Performance**	**Date of Submission**	**Sign.**
302	Abhinav Bakshi	29/02/16	21/03/16	

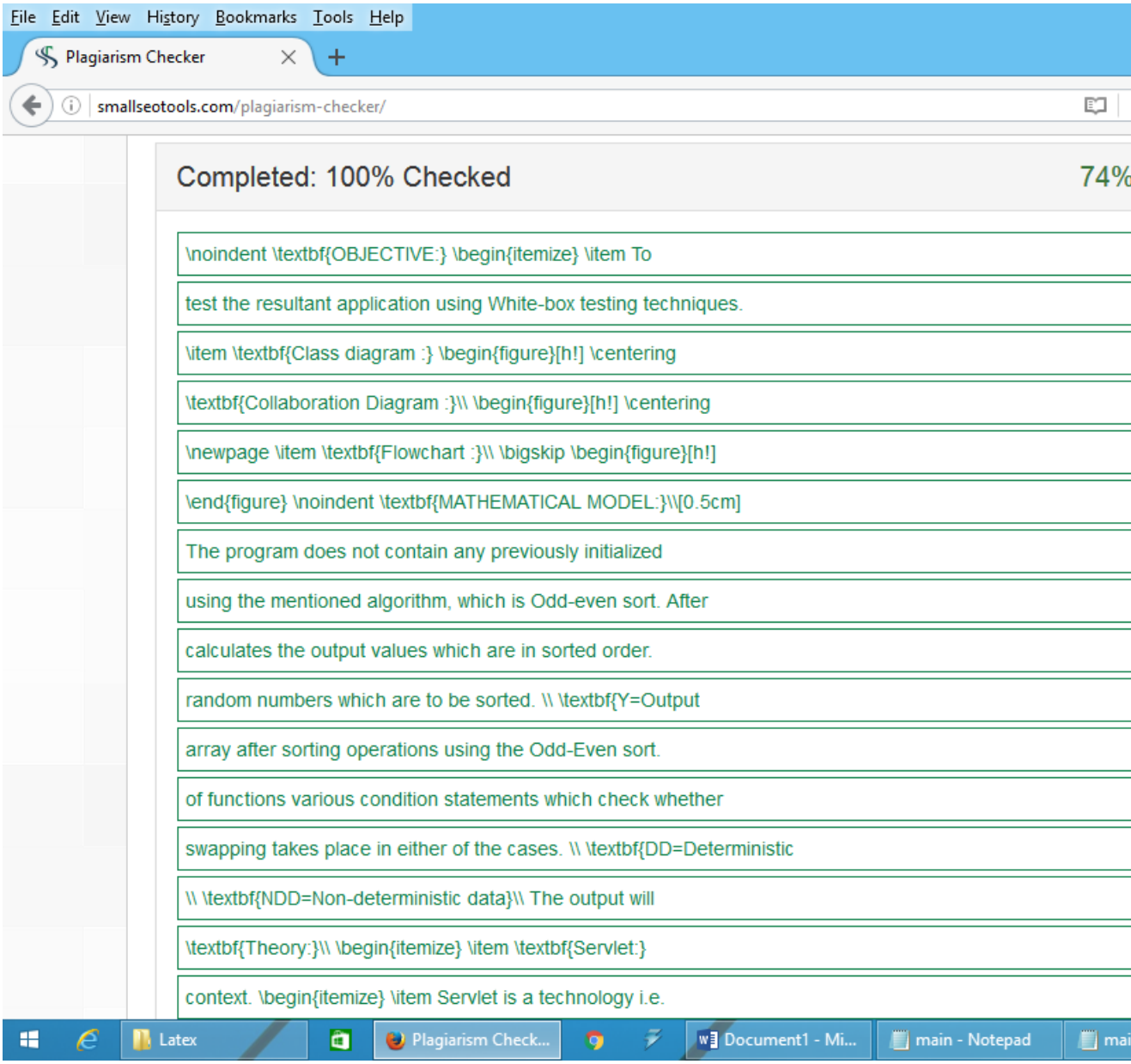


Figure 1: Plagiarism Report