PROJECT 6_REPORT

Vasu Deva Sai Nadha Reddy Janapala Computing Structures

1. In this report, there is a graphical explanation of bubble sort and shell sort algorithms, with respect to metrics like the **number of inversions** and **Chebyshev's distance**.
2. The plots are generated using the **R programming language**. Below is the code used to plot the graphs -

```
# reading the file
data = read.csv("R Projects/project6_report1000.csv")
# bubble sort metrics
dataBubbleInv = data[,c(1,2)]
dataBubbleChey = data[,c(1,3)]
# bubble sort plot
plot(dataBubbleInv, main = "Inversion Bubble Sort")
plot(dataBubbleChey, main = "Cheybshey Bubble sort")

# shell sort data
dataShell = data[1:10,]
# shell sort metrics
dataShellInv = dataShell[,c(1,4)]
dataShellChey = dataShell[,c(1,5)]
# shell sort plot
plot(dataShellInv, main = "Inversion Shell Sort")
plot(dataShellChey, main = "Cheybshey Shell sort")
```

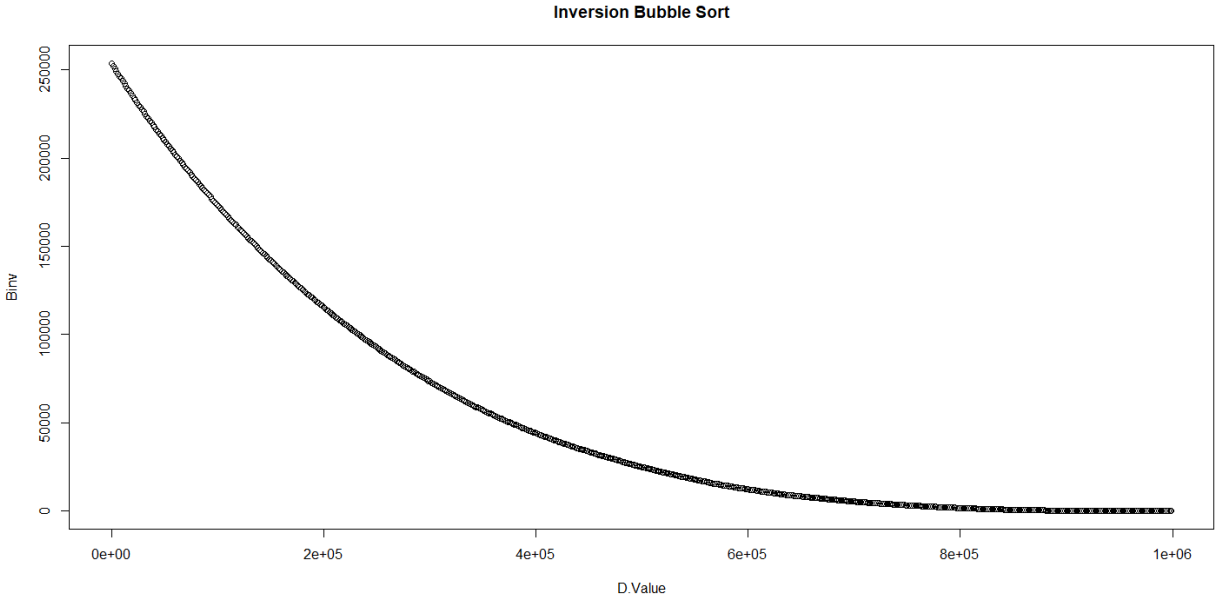
3. In this **D.Value** on the **x-axis** denotes the number of comparisons, **Binv**, and **Sinv** on the **y-axis** denotes the number of inversions, and **Bchey** and **Schey** on the **y-axis** denote Chebyshev's distance.
4. If the number of inversions and Chebyshev's distance goes to zero, the complete sort is considered to happen for the randomly generated elements.
5. This happens only when the number of comparisons increases.
6. As the number of comparisons (D Value) increases, the number of inversions and Chebyshev's distance decreases.
7. Comparison between two sorting algorithms –
   - Bubble sort takes more time to sort, whereas Shell sort takes less time.
   - Needed comparisons for Shell sort are less when compared to Bubble sort.
   - From the above point it is clear that the Shell sort is best than the Bubble sort.
8. **Bubble Sort**:
   - For inversion in bubble sort, it seems like a decreasing type of **exponential graph**.
   - For Chebyshev's in bubble sort, it is the **negative slope;** and after reaching zero, it's a constant.
9. **Shell sort**:
   - In Shell sort, both metrics (inversions, Chebyshev's) plots resemble the decreasing type of **exponential graph**.

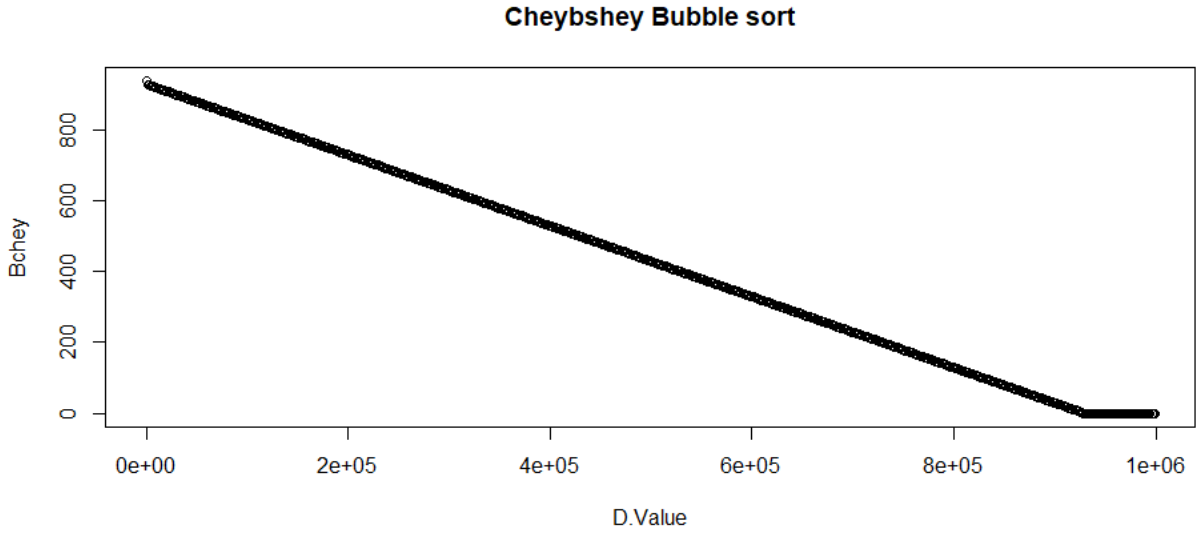
PROJECT 6_REPORT

Vasu Deva Sai Nadha Reddy Janapala Computing Structures

Case 1: n = 1000

Plot for Bubble sort when n=1000 and D goes from 0 to n*n times with an interval of 1500

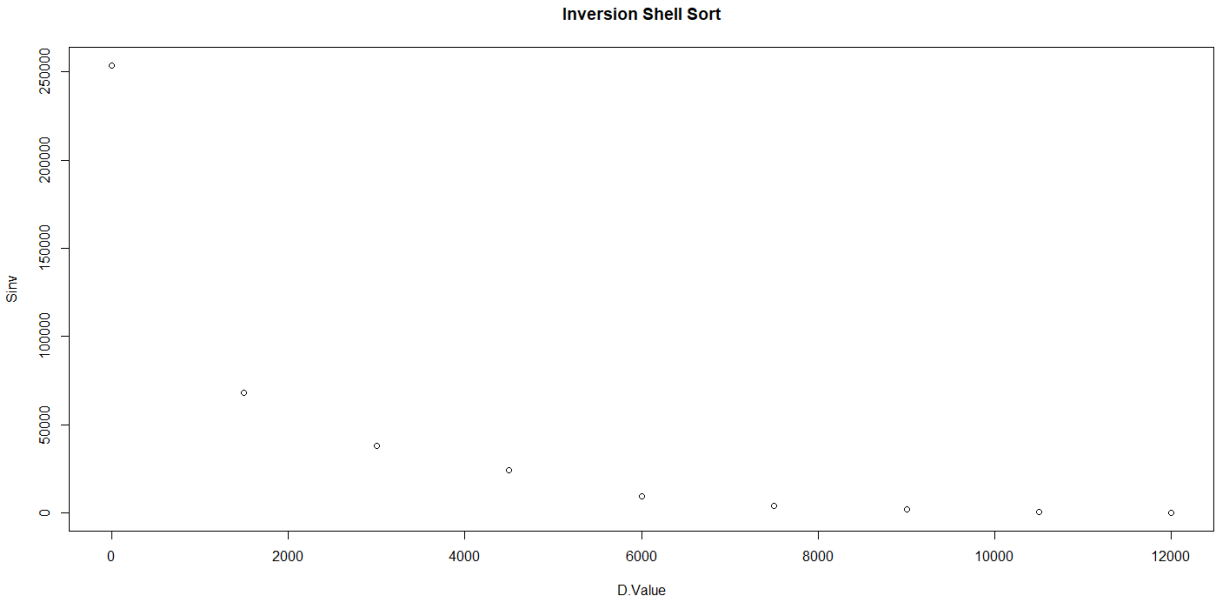


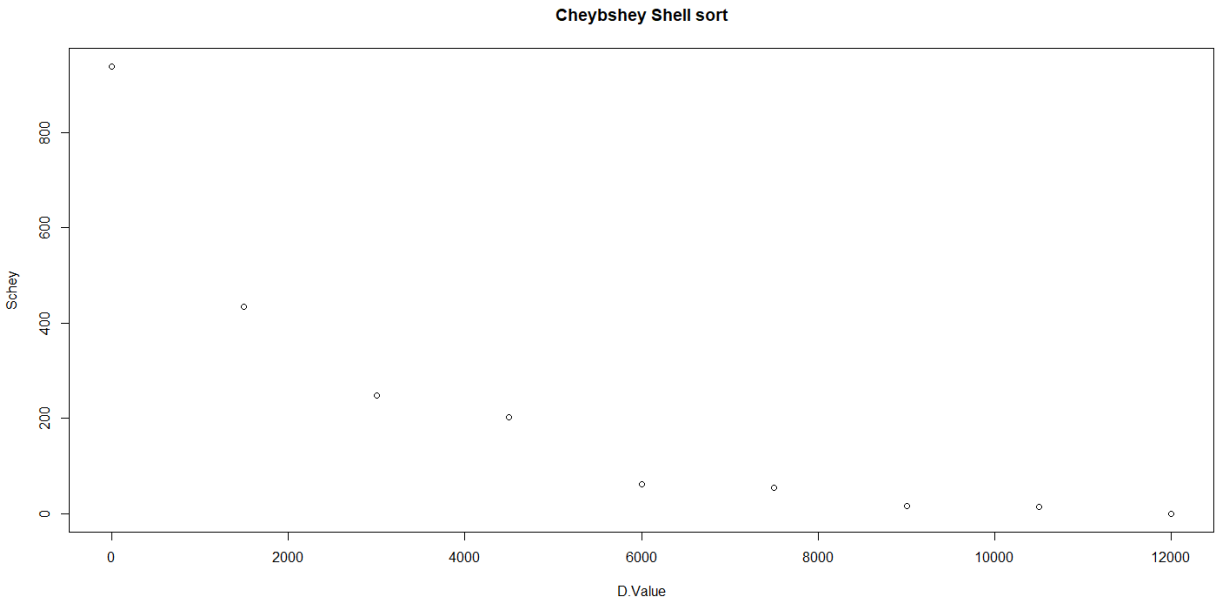


PROJECT 6_REPORT

Vasu Deva Sai Nadha Reddy Janapala Computing Structures

Plot for Shell sort when n=1000 and D goes from 0 to n*n times with an interval of 1500



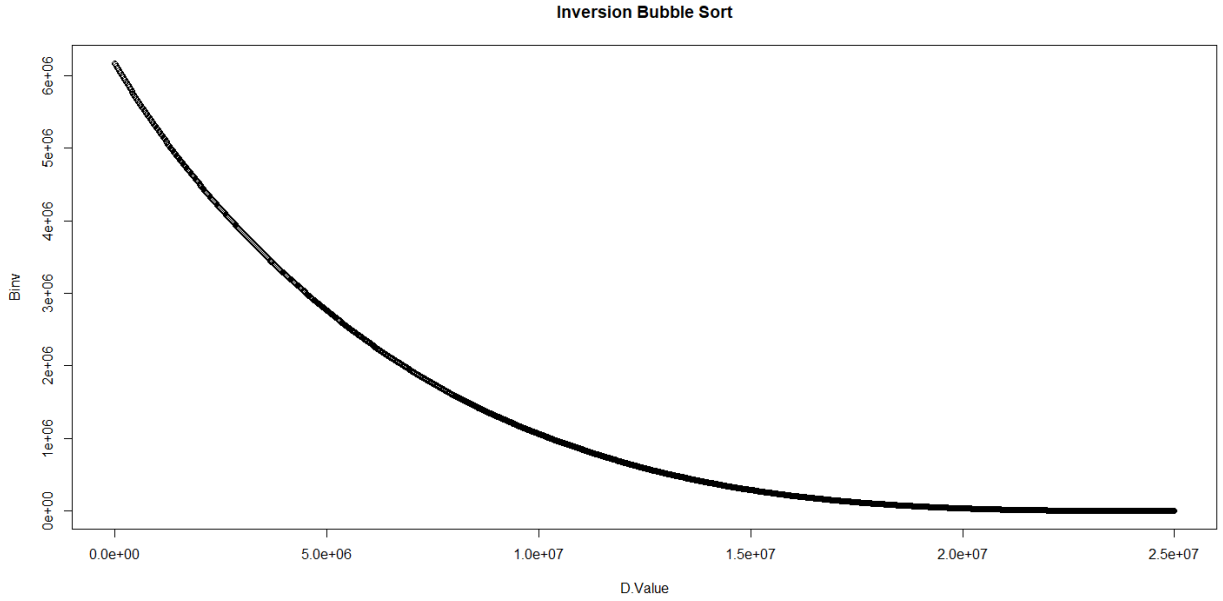


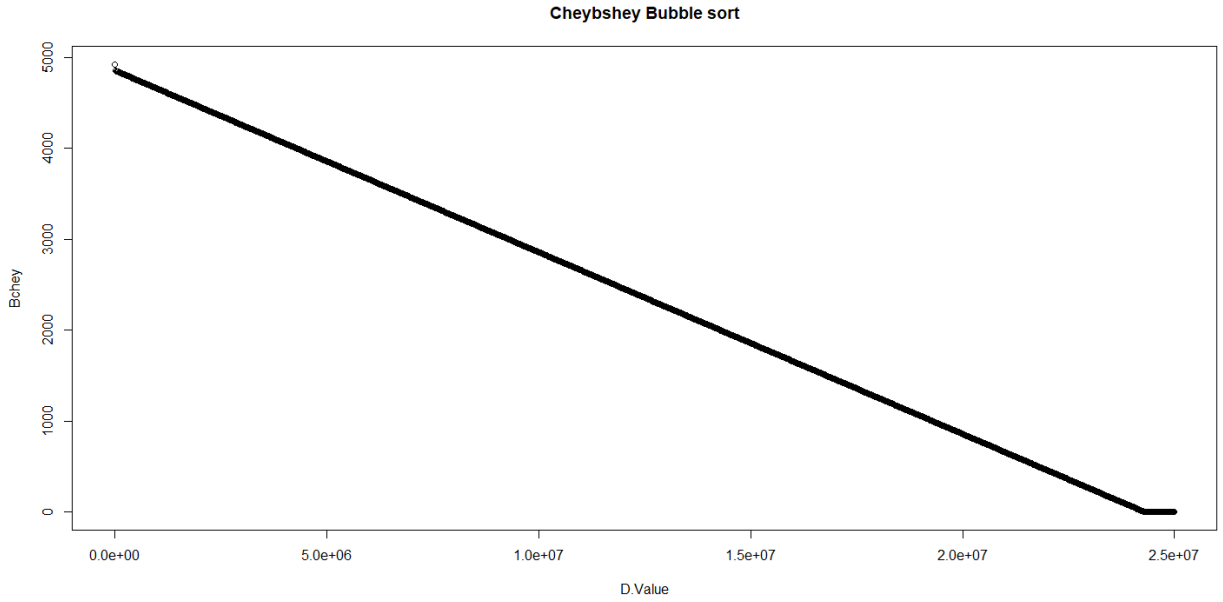
PROJECT 6_REPORT

Vasu Deva Sai Nadha Reddy Janapala Computing Structures

Case2: n = 5000

Plot for Bubble sort when n=5000 and D goes from 0 to n*n times with an interval of 20000

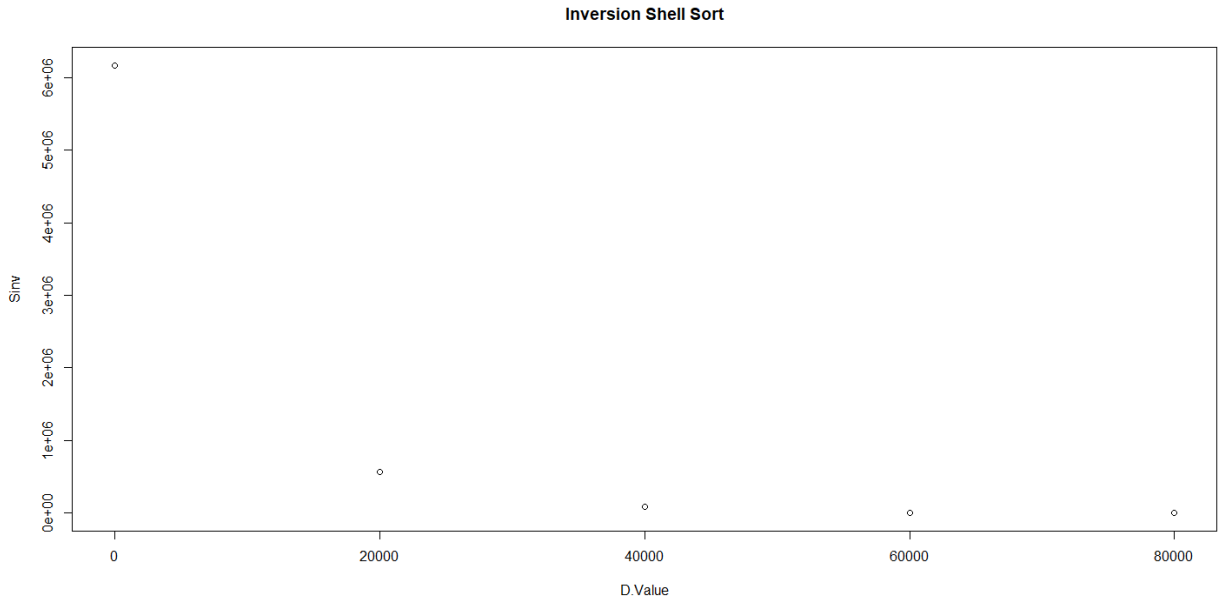


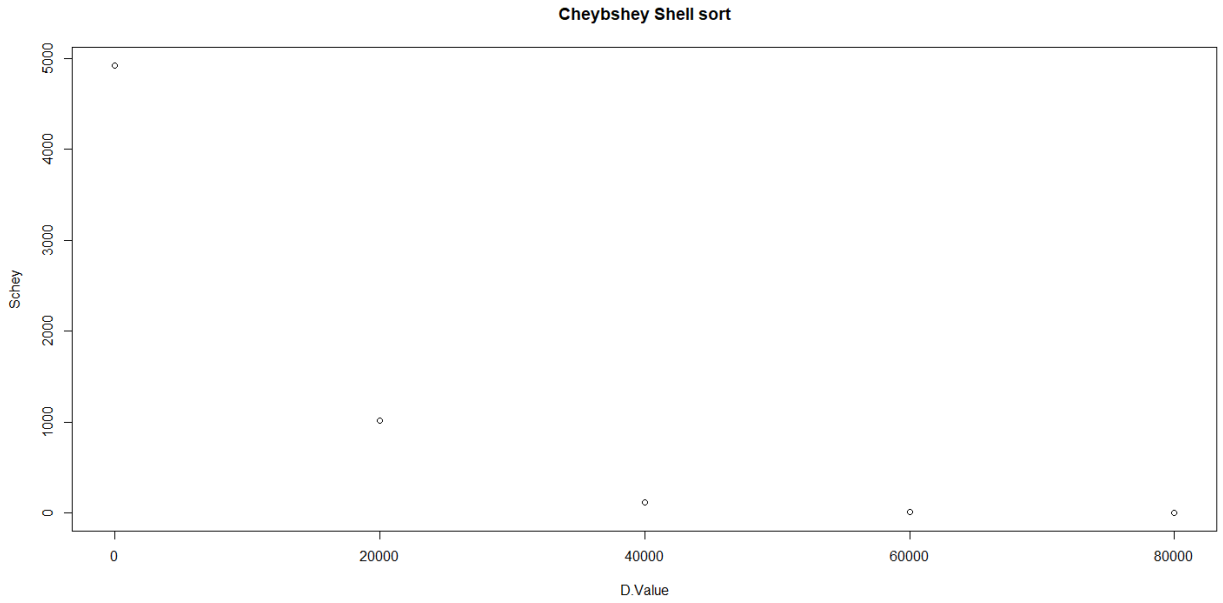


PROJECT 6_REPORT

Vasu Deva Sai Nadha Reddy Janapala Computing Structures

Plot for Shell sort when n=5000 and D goes from 0 to n*n times with an interval of 20000



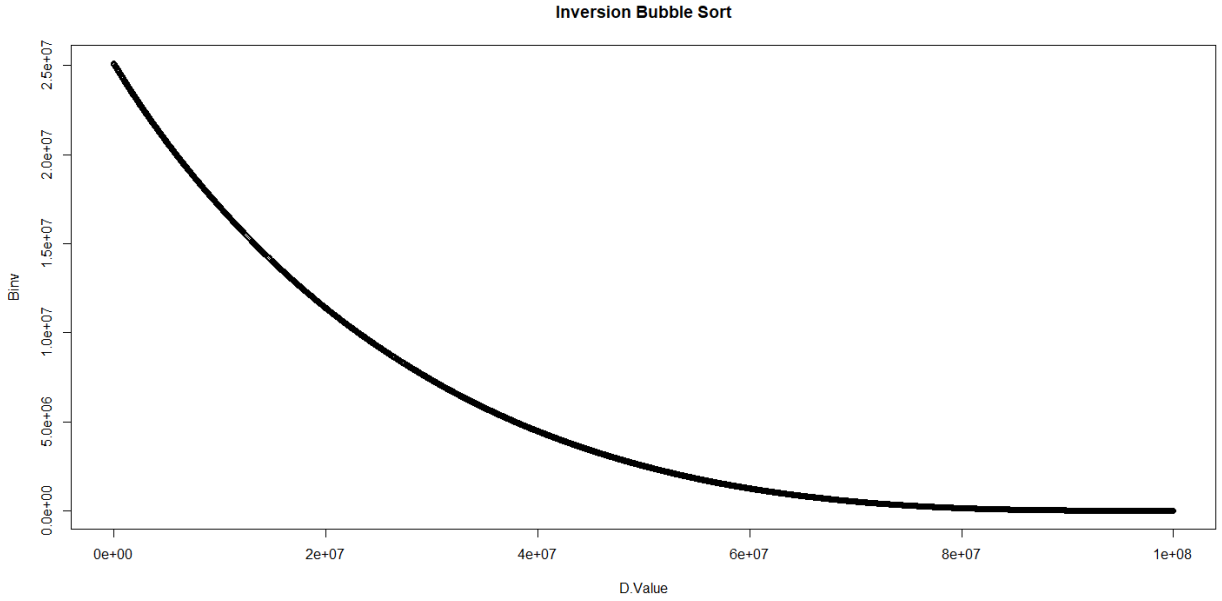


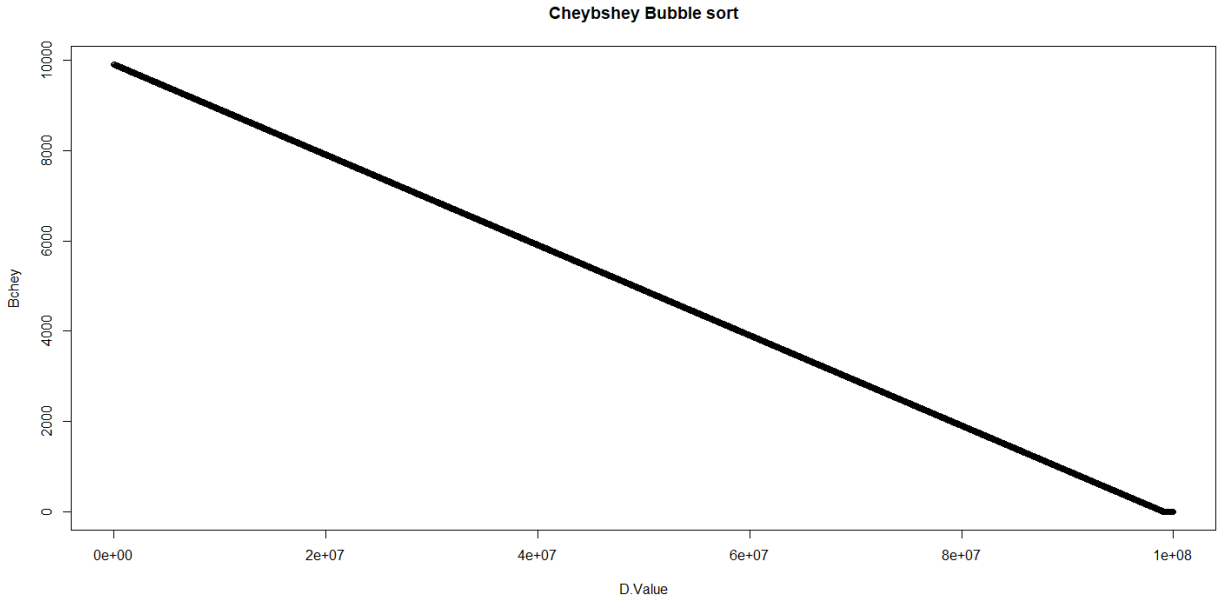
PROJECT 6_REPORT

Vasu Deva Sai Nadha Reddy Janapala Computing Structures

Case 3: n = 10000

Plot for Bubble sort when n=10000 and D goes from 0 to n*n times with an interval of 20000

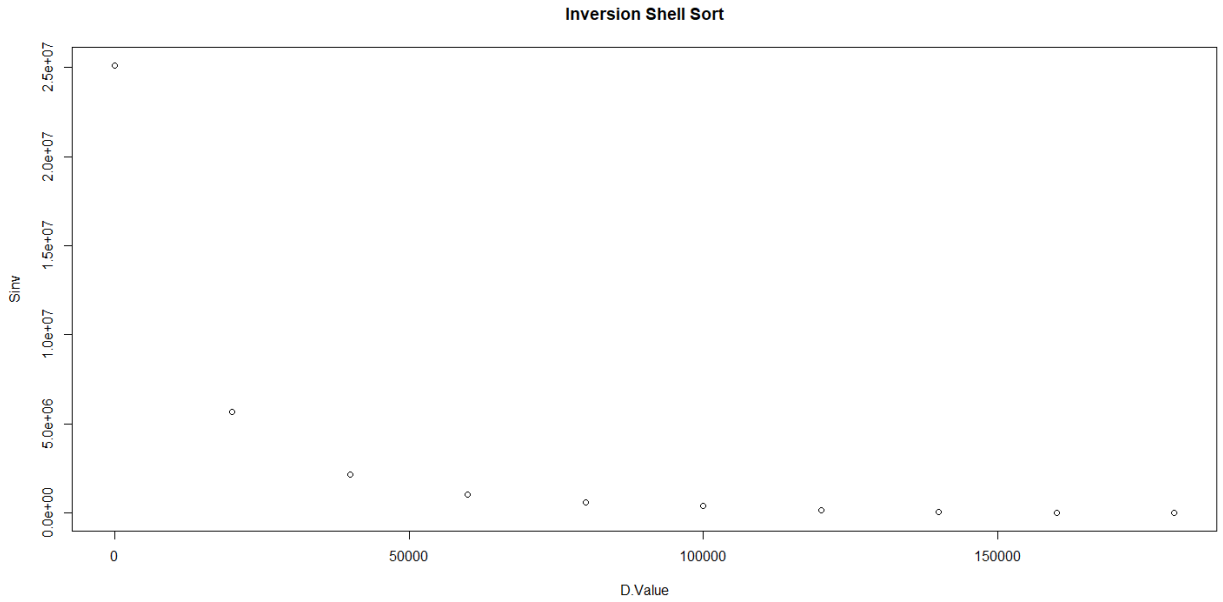


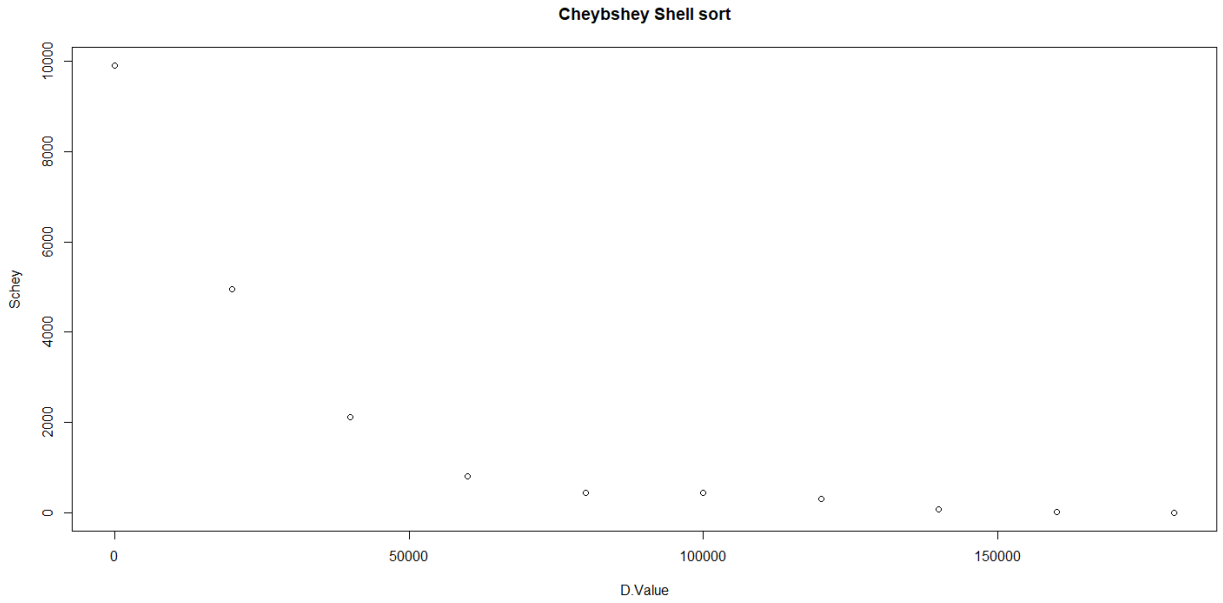


PROJECT 6_REPORT

Vasu Deva Sai Nadha Reddy Janapala Computing Structures

Plot for Shell sort when n=10000 and D goes from 0 to n*n times with an interval of 20000



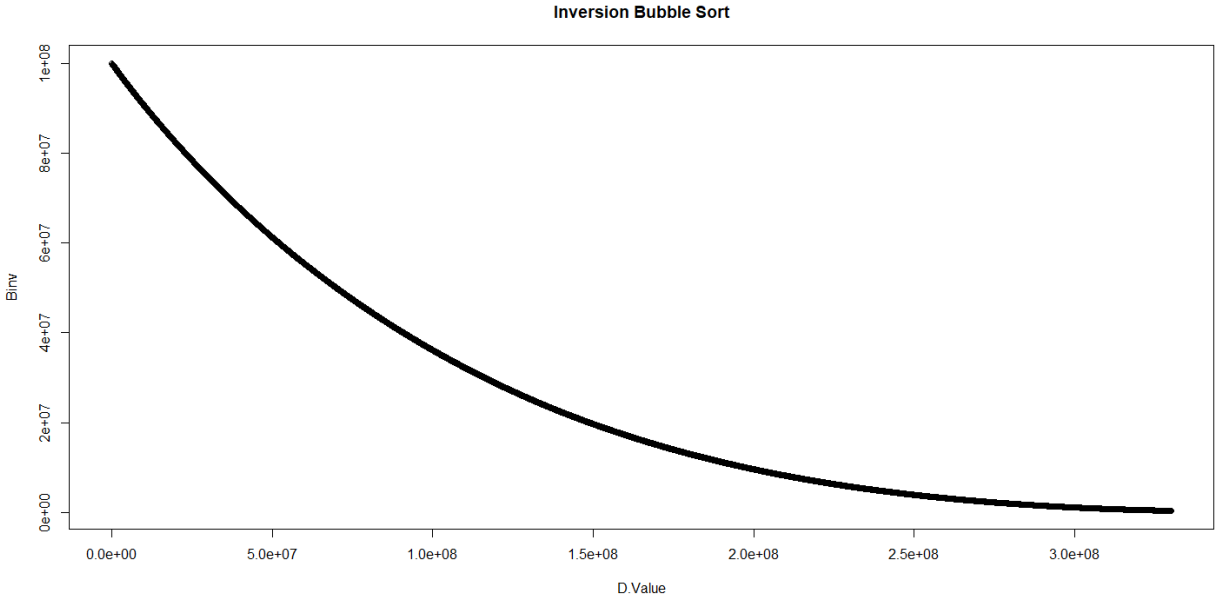


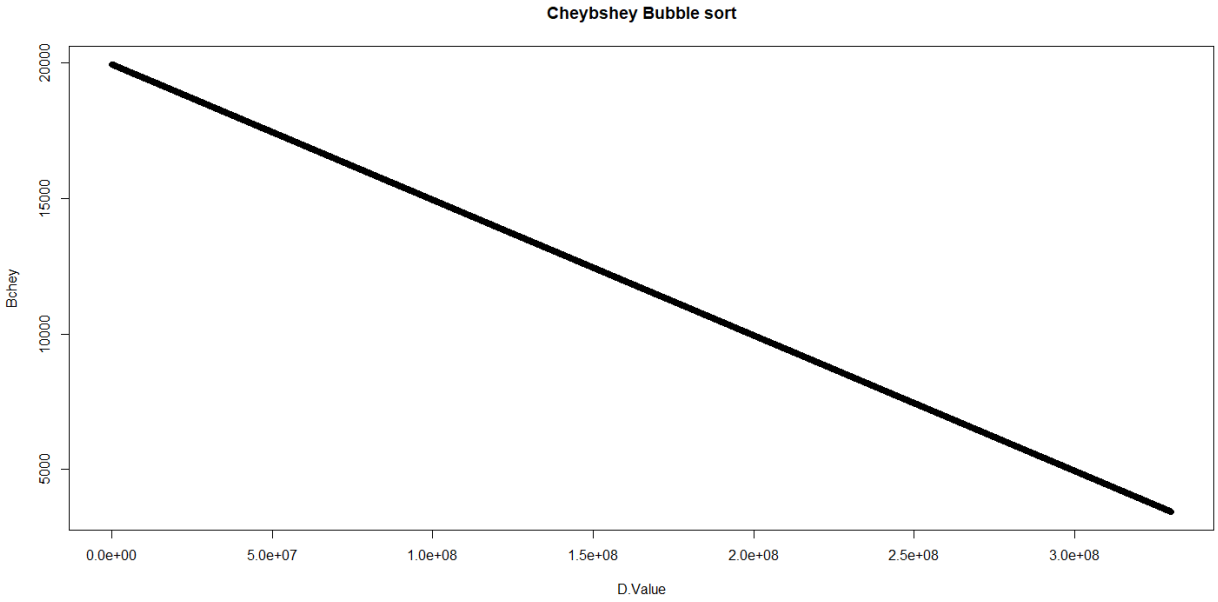
PROJECT 6_REPORT

Vasu Deva Sai Nadha Reddy Janapala Computing Structures

Case 4: n = 20000

Plot for Bubble sort when n=20000 and D goes from 0 to n*n times with an interval of 50000

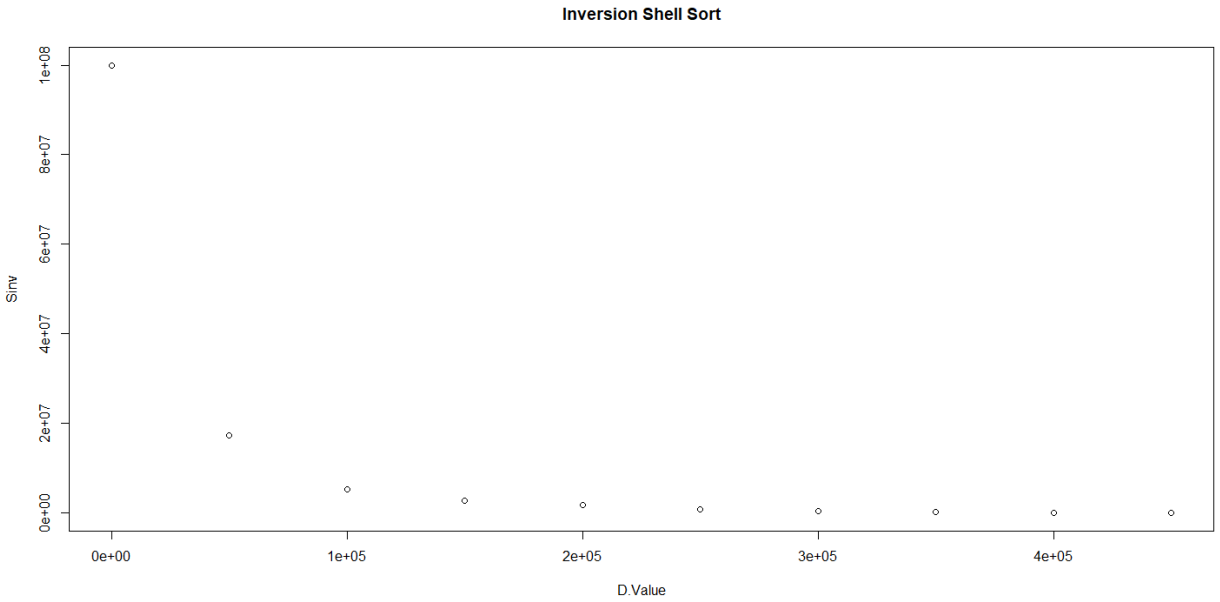


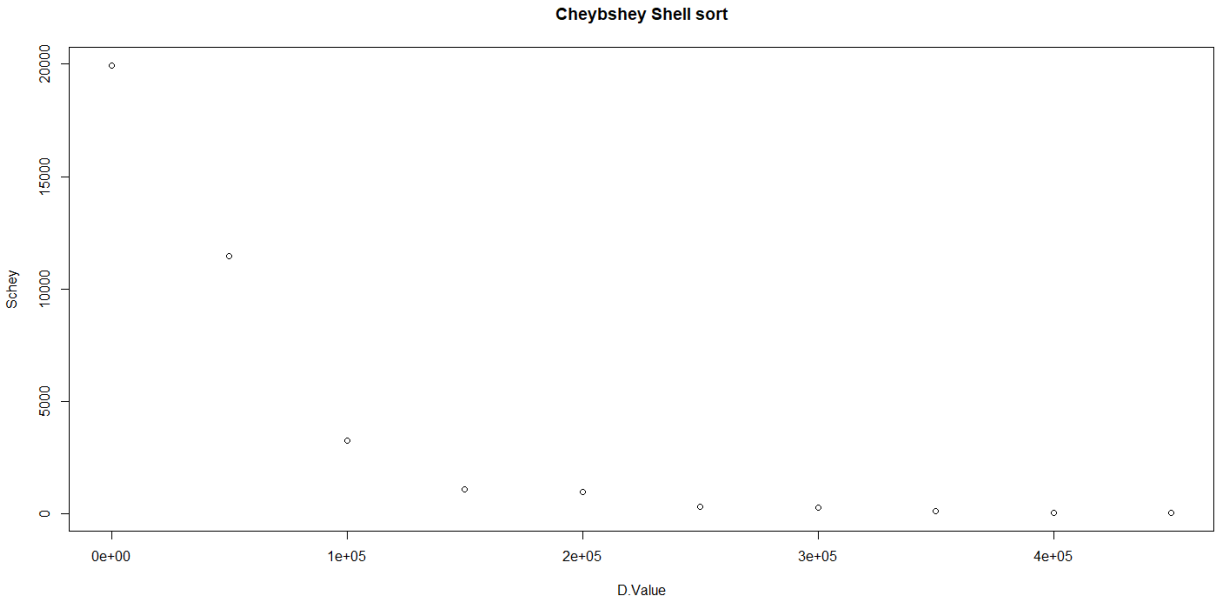


PROJECT 6_REPORT

Vasu Deva Sai Nadha Reddy Janapala Computing Structures

Plot for Shell sort when n=20000 and D goes from 0 to n*n times with an interval of 50000



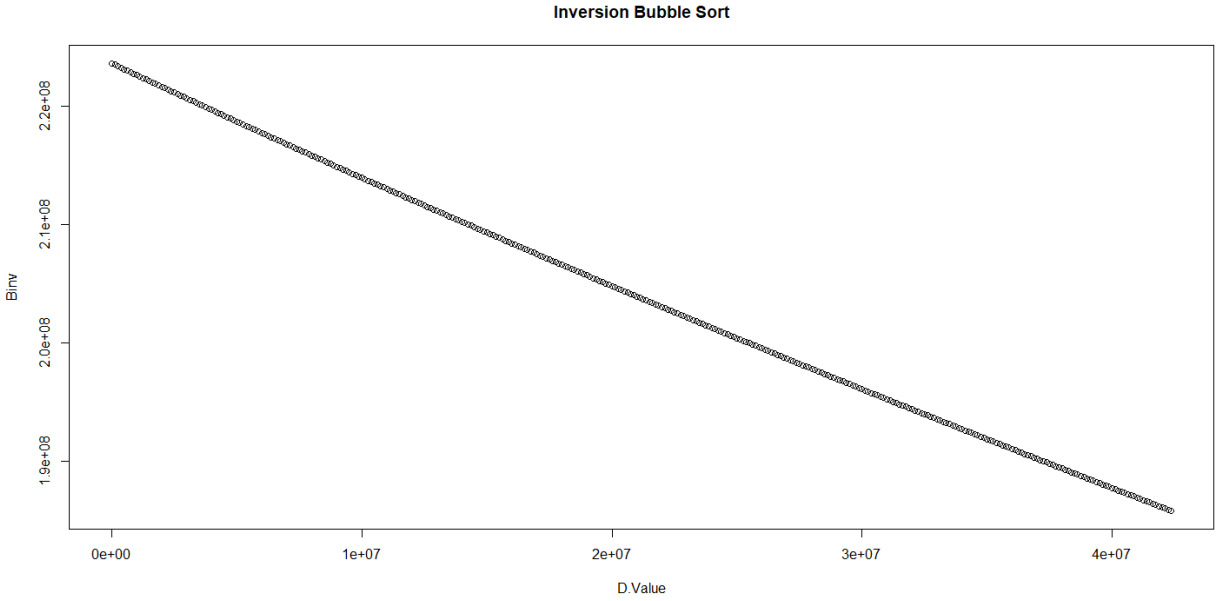


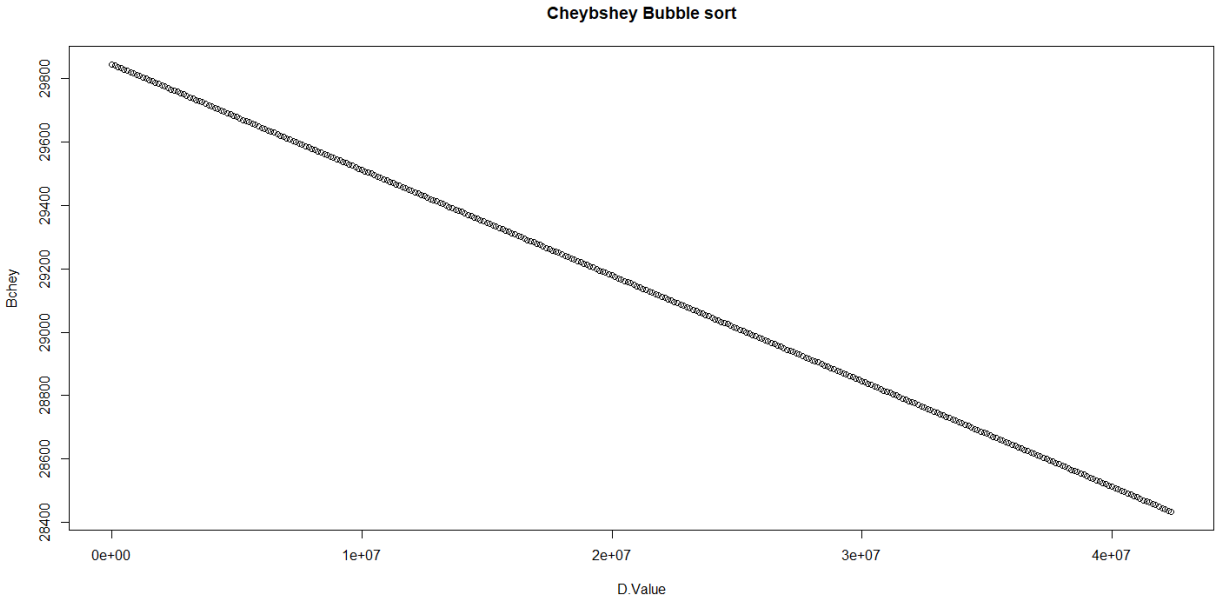
PROJECT 6_REPORT

Vasu Deva Sai Nadha Reddy Janapala Computing Structures

Case 5: n = 30000

Plot for Bubble sort when n=30000 and D goes from 0 to n*n times with an interval of 125000





PROJECT 6_REPORT

Vasu Deva Sai Nadha Reddy Janapala Computing Structures

Plot for Shell sort when n=30000 and D goes from 0 to n*n times with an interval of 125000