DC ASSIGNMENT – 1

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Task: **Implementing the distributing sorting algorithms on a line network.**

Algorithm 1:

(a) Odd-Even Transposition Algorithm for distributed sorting on a line network

Output:

For parity “<=” and n = 5:

```
PS C:\Users\sai\Documents\Academic\SEM 6\DC\Assign\Assign 1\Code\OddEven> java OddEven

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Enter n (processing entities) : 5
Entities Before Applying Sorting :
159 290 463 308 119

Parity selection:
For '<=' enter 0
For '>='  enter 1:
0

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For Iteration 0 :
159 290 119 463 308
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For Iteration 1 :
119 159 290 308 463
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For Iteration 2 :
119 159 290 308 463
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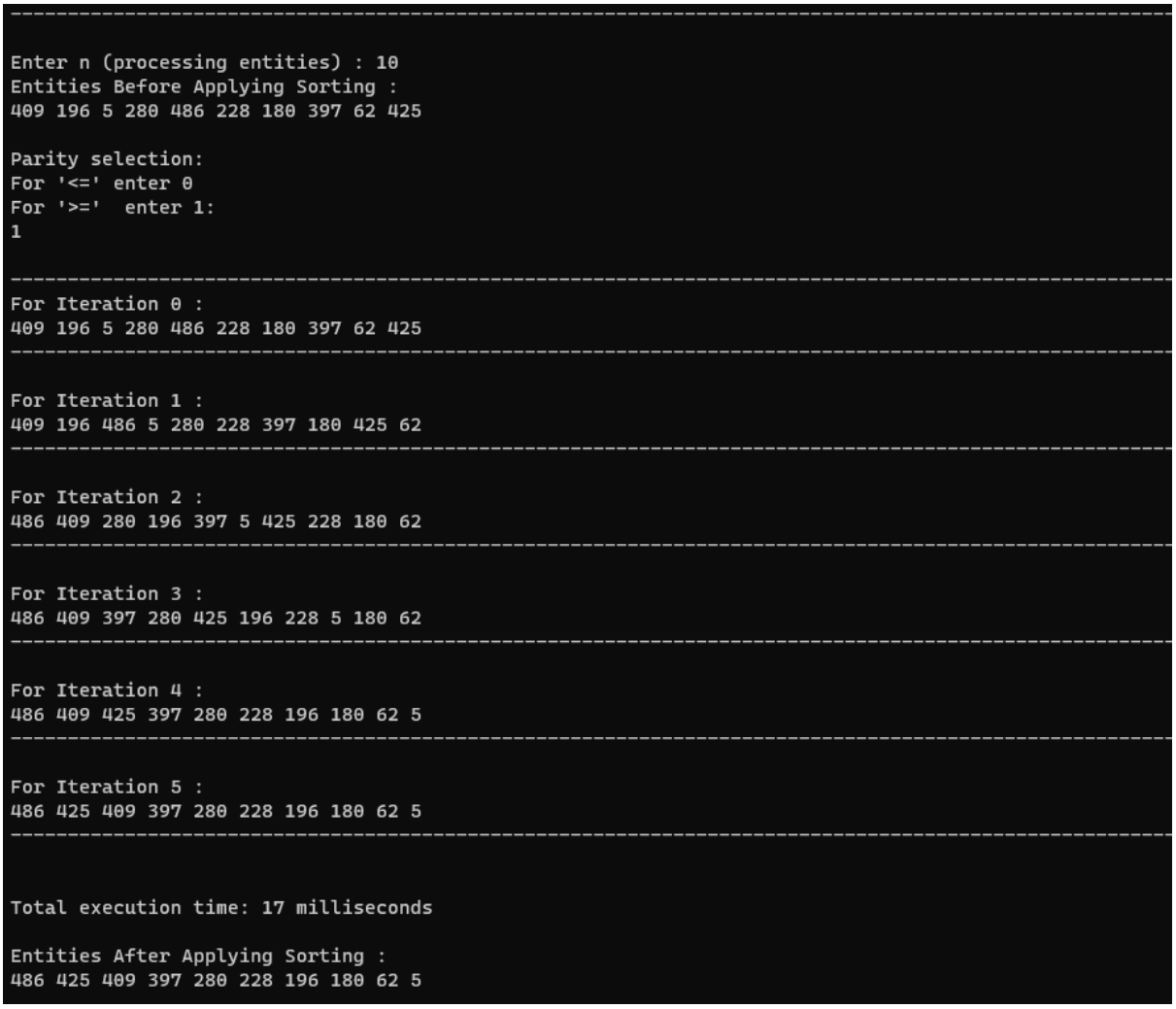
Total execution time: 6 milliseconds

Entities After Applying Sorting :
119 159 290 308 463
```

For parity “>=” and n = 10:



Time complexity: O(n^2)
Space Complexity: O (1)

Algorithm 2:

(b) Sasaki's time-optimal algorithm for distributed sorting on a line network

Output:

For parity “<=” and n = 5:

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Enter n (processing entities) : 5
Entities Before Applying Sorting :
67 98 41 48 39

Parity selection:
For '<=' enter 0
For '>='  enter 1:
0

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For Round no: 0
|67* (area = -1)|  |98,98 (area = 0)|  |41,41 (area = 0)|  |48,48 (area = 0)|  |39* (area = 0)|
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For Round no: 1
|67* (area = -1)|  |41,98 (area = 0)|  |41,98 (area = 0)|  |39*,48 (area = 0)|  |48 (area = 1)|
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For Round no: 2
|41 (area = -1)|  |41,67* (area = -1)|  |39*,98 (area = 0)|  |48,98 (area = 1)|  |48 (area = 1)|
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For Round no: 3
|41 (area = -1)|  |39*,41 (area = -1)|  |48,67* (area = 0)|  |48,98 (area = 1)|  |98 (area = 1)|
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For Round no: 4
|39* (area = -1)|  |41,41 (area = 0)|  |48,48 (area = 0)|  |67*,98 (area = 0)|  |98 (area = 1)|
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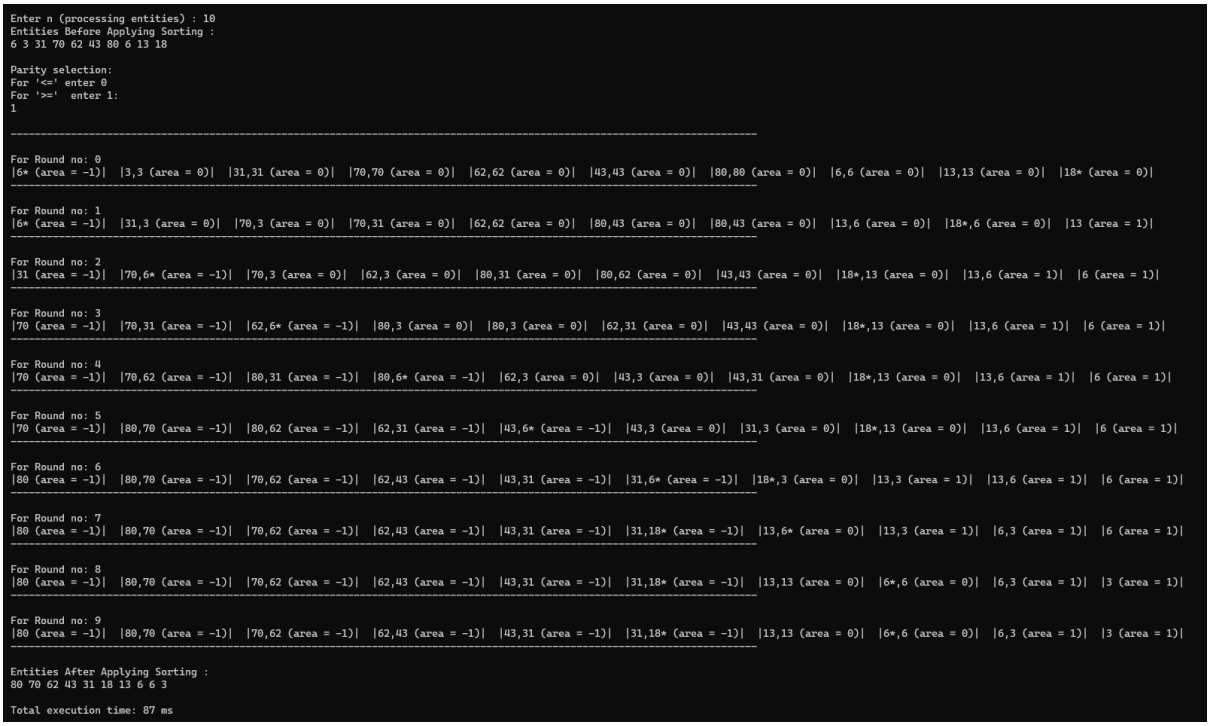
Entities After Applying Sorting :
39 41 48 67 98

Total execution time: 256 ms
```

For parity “>=” and n = 10:



```
Enter n (processing entities) : 10
Entities Before Applying Sorting :
6 3 31 70 62 43 80 6 13 18

Parity selection:
For '<=' enter 0
For '>='  enter 1:
1

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For Round no: 0
|6* (area = -1)|  |3,3 (area = 0)|  |31,31 (area = 0)|  |70,70 (area = 0)|  |62,62 (area = 0)|  |43,43 (area = 0)|  |80,80 (area = 0)|  |6,6 (area = 0)|  |13,13 (area = 0)|  |18* (area = 0)|
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For Round no: 1
|6* (area = -1)|  |31,3 (area = 0)|  |70,3 (area = 0)|  |70,31 (area = 0)|  |62,62 (area = 0)|  |80,43 (area = 0)|  |80,43 (area = 0)|  |13,6 (area = 0)|  |18*,6 (area = 0)|  |13 (area = 1)|
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For Round no: 2
|31 (area = -1)|  |70,6* (area = -1)|  |70,3 (area = 0)|  |62,3 (area = 0)|  |80,31 (area = 0)|  |80,62 (area = 0)|  |43,43 (area = 0)|  |18*,13 (area = 0)|  |13,6 (area = 1)|  |6 (area = 1)|
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For Round no: 3
|70 (area = -1)|  |70,31 (area = -1)|  |62,6* (area = -1)|  |80,3 (area = 0)|  |80,3 (area = 0)|  |62,31 (area = 0)|  |43,43 (area = 0)|  |18*,13 (area = 0)|  |13,6 (area = 1)|  |6 (area = 1)|
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For Round no: 4
|70 (area = -1)|  |70,62 (area = -1)|  |80,31 (area = -1)|  |80,6* (area = -1)|  |62,3 (area = 0)|  |43,3 (area = 0)|  |43,31 (area = 0)|  |18*,13 (area = 0)|  |13,6 (area = 1)|  |6 (area = 1)|
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For Round no: 5
|70 (area = -1)|  |80,70 (area = -1)|  |80,62 (area = -1)|  |62,31 (area = -1)|  |43,6* (area = -1)|  |43,3 (area = 0)|  |31,3 (area = 0)|  |18*,13 (area = 0)|  |13,6 (area = 1)|  |6 (area = 1)|
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For Round no: 6
|80 (area = -1)|  |80,70 (area = -1)|  |70,62 (area = -1)|  |62,43 (area = -1)|  |43,31 (area = -1)|  |31,6* (area = -1)|  |18*,3 (area = 0)|  |13,3 (area = 1)|  |13,6 (area = 1)|  |6 (area = 1)|
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For Round no: 7
|80 (area = -1)|  |80,70 (area = -1)|  |70,62 (area = -1)|  |62,43 (area = -1)|  |43,31 (area = -1)|  |31,18* (area = -1)|  |13,6* (area = 0)|  |13,3 (area = 1)|  |6,3 (area = 1)|  |6 (area = 1)|
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For Round no: 8
|80 (area = -1)|  |80,70 (area = -1)|  |70,62 (area = -1)|  |62,43 (area = -1)|  |43,31 (area = -1)|  |31,18* (area = -1)|  |13,13 (area = 0)|  |6*,6 (area = 0)|  |6,3 (area = 1)|  |3 (area = 1)|
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For Round no: 9
|80 (area = -1)|  |80,70 (area = -1)|  |70,62 (area = -1)|  |62,43 (area = -1)|  |43,31 (area = -1)|  |31,18* (area = -1)|  |13,13 (area = 0)|  |6*,6 (area = 0)|  |6,3 (area = 1)|  |3 (area = 1)|
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Entities After Applying Sorting :
80 70 62 43 31 18 13 6 6 3

Total execution time: 87 ms
```

Time complexity: O(n^2)

Space Complexity: O (n)

Algorithm 3:

(c) An alternative time-optimal algorithm for distributed sorting on a line network

Output:

For parity “<=” and n = 5:

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Enter n (processing entities) : 5

Entities Before Applying Sorting :
73 20 22 7 96

Parity selection:
For '<=' enter 0
For '>='  enter 1:
0


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For Round no: 0

|73 (mod = 0)|  |20 (mod = 1)|  |22 (mod = 2)|  |7 (mod = 0)|  |96 (mod = 1)|
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For Round no: 1

|20 (mod = 2)|  |22 (mod = 0)|  |73 (mod = 1)|  |7 (mod = 2)|  |96 (mod = 0)|
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For Round no: 2

|20 (mod = 1)|  |7 (mod = 2)|  |22 (mod = 0)|  |73 (mod = 1)|  |96 (mod = 2)|
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For Round no: 3

|7 (mod = 0)|  |20 (mod = 1)|  |22 (mod = 2)|  |73 (mod = 0)|  |96 (mod = 1)|
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For Round no: 4

|7 (mod = 2)|  |20 (mod = 0)|  |22 (mod = 1)|  |73 (mod = 2)|  |96 (mod = 0)|
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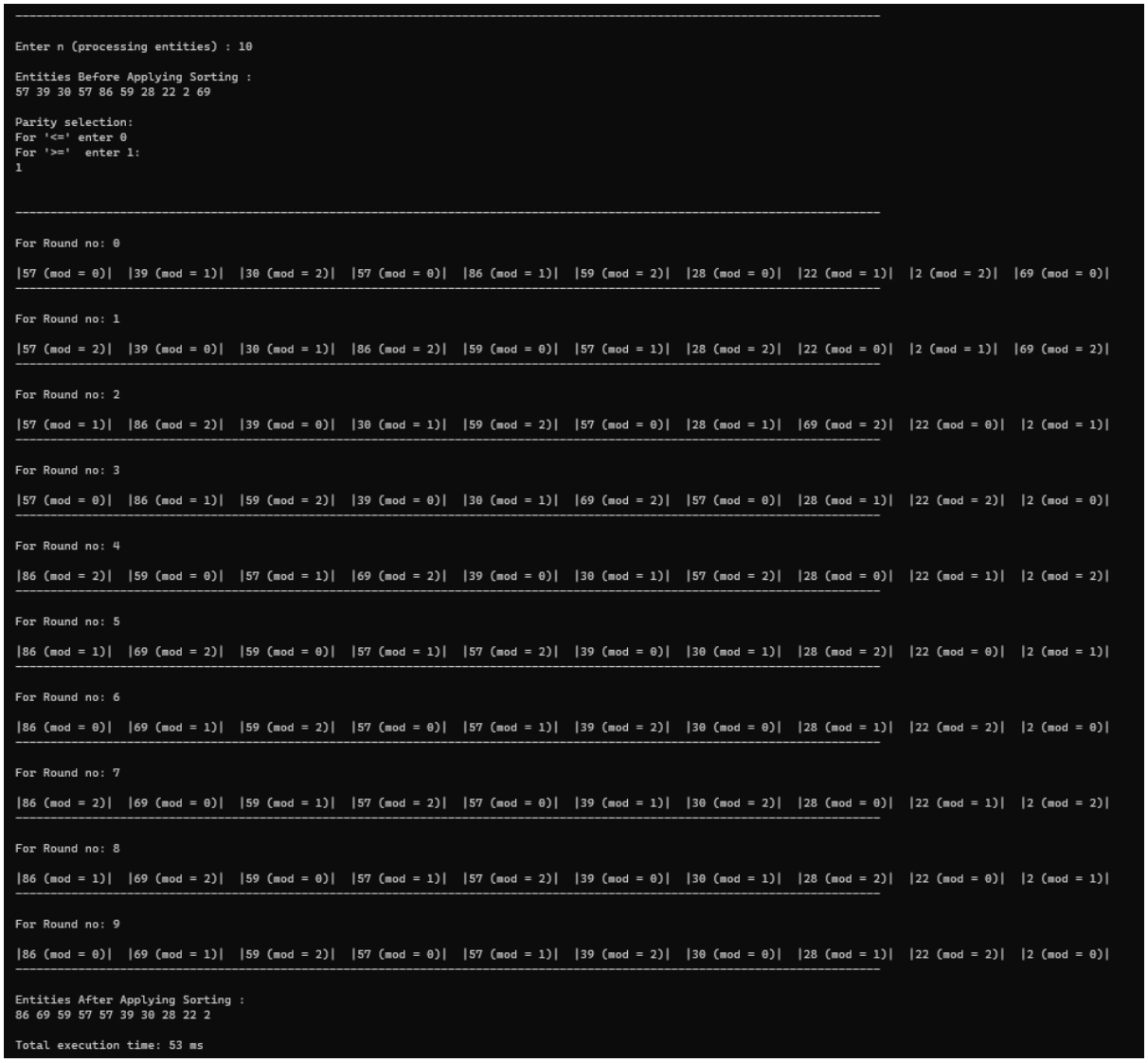
Entities After Applying Sorting :
7 20 22 73 96

Total execution time: 23 ms
```

For parity “>=” and n = 10:



```
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Enter n (processing entities) : 10

Entities Before Applying Sorting :
57 39 30 57 86 59 28 22 2 69

Parity selection:
For '<=' enter 0
For '>='  enter 1:
1


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For Round no: 0

|57 (mod = 0)|  |39 (mod = 1)|  |30 (mod = 2)|  |57 (mod = 0)|  |86 (mod = 1)|  |59 (mod = 2)|  |28 (mod = 0)|  |22 (mod = 1)|  |2 (mod = 2)|  |69 (mod = 0)|
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For Round no: 1

|57 (mod = 2)|  |39 (mod = 0)|  |30 (mod = 1)|  |86 (mod = 2)|  |59 (mod = 0)|  |57 (mod = 1)|  |28 (mod = 2)|  |22 (mod = 0)|  |2 (mod = 1)|  |69 (mod = 2)|
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For Round no: 2

|57 (mod = 1)|  |86 (mod = 2)|  |39 (mod = 0)|  |30 (mod = 1)|  |59 (mod = 2)|  |57 (mod = 0)|  |28 (mod = 1)|  |69 (mod = 2)|  |22 (mod = 0)|  |2 (mod = 1)|
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For Round no: 3

|57 (mod = 0)|  |86 (mod = 1)|  |59 (mod = 2)|  |39 (mod = 0)|  |30 (mod = 1)|  |69 (mod = 2)|  |57 (mod = 0)|  |28 (mod = 1)|  |22 (mod = 2)|  |2 (mod = 0)|
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For Round no: 4

|86 (mod = 2)|  |59 (mod = 0)|  |57 (mod = 1)|  |69 (mod = 2)|  |39 (mod = 0)|  |30 (mod = 1)|  |57 (mod = 2)|  |28 (mod = 0)|  |22 (mod = 1)|  |2 (mod = 2)|
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For Round no: 5

|86 (mod = 1)|  |69 (mod = 2)|  |59 (mod = 0)|  |57 (mod = 1)|  |57 (mod = 2)|  |39 (mod = 0)|  |30 (mod = 1)|  |28 (mod = 2)|  |22 (mod = 0)|  |2 (mod = 1)|
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For Round no: 6

|86 (mod = 0)|  |69 (mod = 1)|  |59 (mod = 2)|  |57 (mod = 0)|  |57 (mod = 1)|  |39 (mod = 2)|  |30 (mod = 0)|  |28 (mod = 1)|  |22 (mod = 2)|  |2 (mod = 0)|
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For Round no: 7

|86 (mod = 2)|  |69 (mod = 0)|  |59 (mod = 1)|  |57 (mod = 2)|  |57 (mod = 0)|  |39 (mod = 1)|  |30 (mod = 2)|  |28 (mod = 0)|  |22 (mod = 1)|  |2 (mod = 2)|
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For Round no: 8

|86 (mod = 1)|  |69 (mod = 2)|  |59 (mod = 0)|  |57 (mod = 1)|  |57 (mod = 2)|  |39 (mod = 0)|  |30 (mod = 1)|  |28 (mod = 2)|  |22 (mod = 0)|  |2 (mod = 1)|
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For Round no: 9

|86 (mod = 0)|  |69 (mod = 1)|  |59 (mod = 2)|  |57 (mod = 0)|  |57 (mod = 1)|  |39 (mod = 2)|  |30 (mod = 0)|  |28 (mod = 1)|  |22 (mod = 2)|  |2 (mod = 0)|
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Entities After Applying Sorting :
86 69 59 57 57 39 30 28 22 2

Total execution time: 53 ms
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Time complexity: O(n^2)
Space Complexity: O (n)

Comparison Table:

Table for time of execution for different algorithms for different n.

Algo\Time	N= 10	N=20	N=30	N=50
Alternative	50ms	160ms	298ms	322ms
Sasaki	94ms	139ms	277ms	583ms
Odd-Even	13ms	49ms	81ms	126ms

Observation:

From table we can say that time was increasing with entities. But we Cannot compare algorithms with these time values as we are using random generator for values, it may generate descending or ascending values with effect the time complexity.

But in general, Odd-Even takes less time because it does not use threading.