Mithil Vasani.

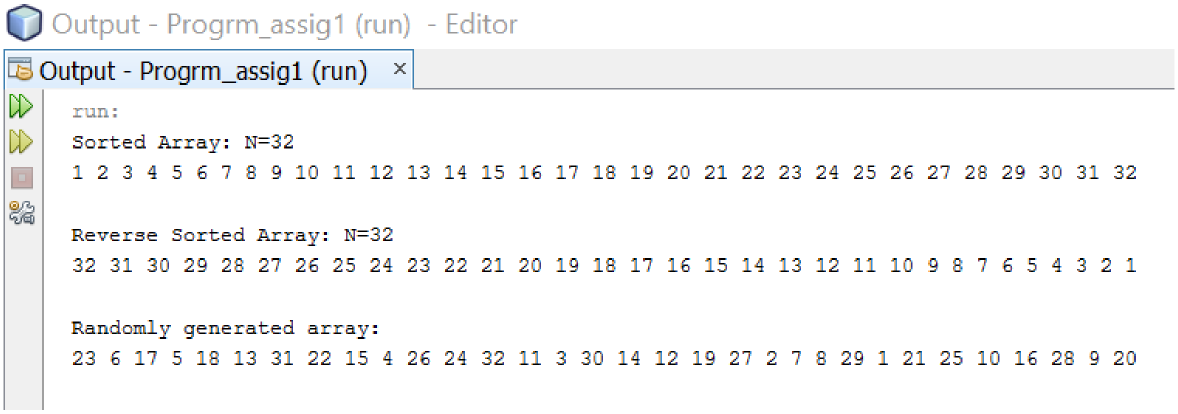
1) N= 32

NOTE:

- Run “Progrm_assign1.java”
- No external Input to be provided.

o/p

1) Sorted, Reverse Sorted, and Randomly Generated Array

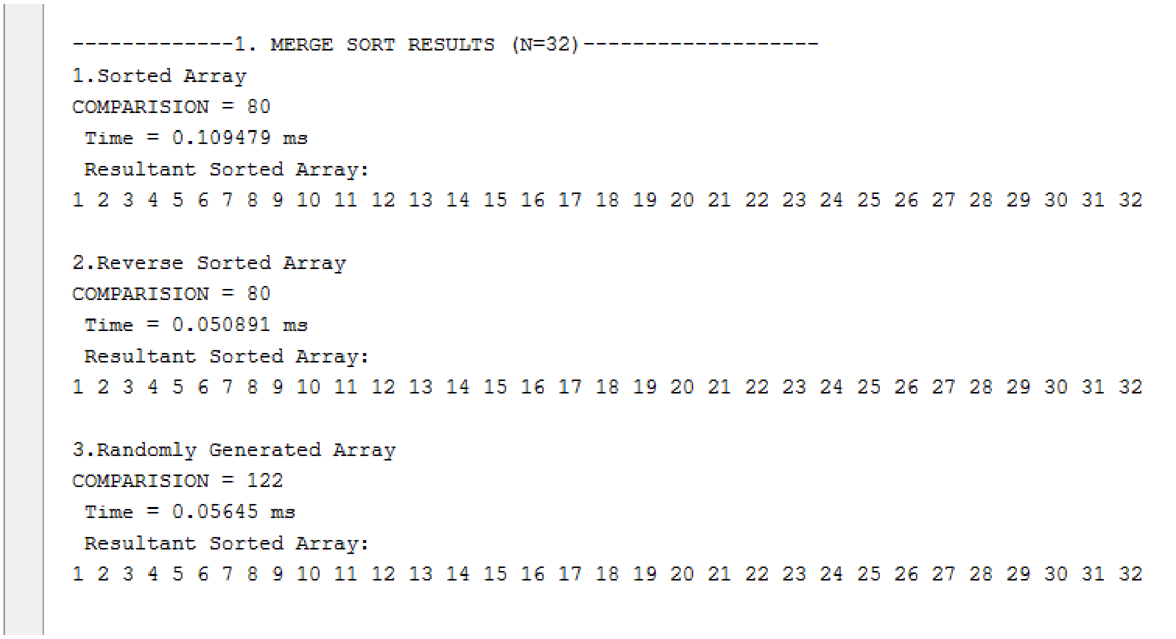

Output - Progrm_assig1 (run) - Editor
Output - Progrm_assig1 (run) ×

```
run:
Sorted Array: N=32
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

Reverse Sorted Array: N=32
32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

Randomly generated array:
23 6 17 5 18 13 31 22 15 4 26 24 32 11 3 30 14 12 19 27 2 7 8 29 1 21 25 10 16 28 9 20
```

2) Merge Sort Results – In below result for merge 1. Shows the Best Case, 2. Shows the Worst Case, 3. Shows the Average case

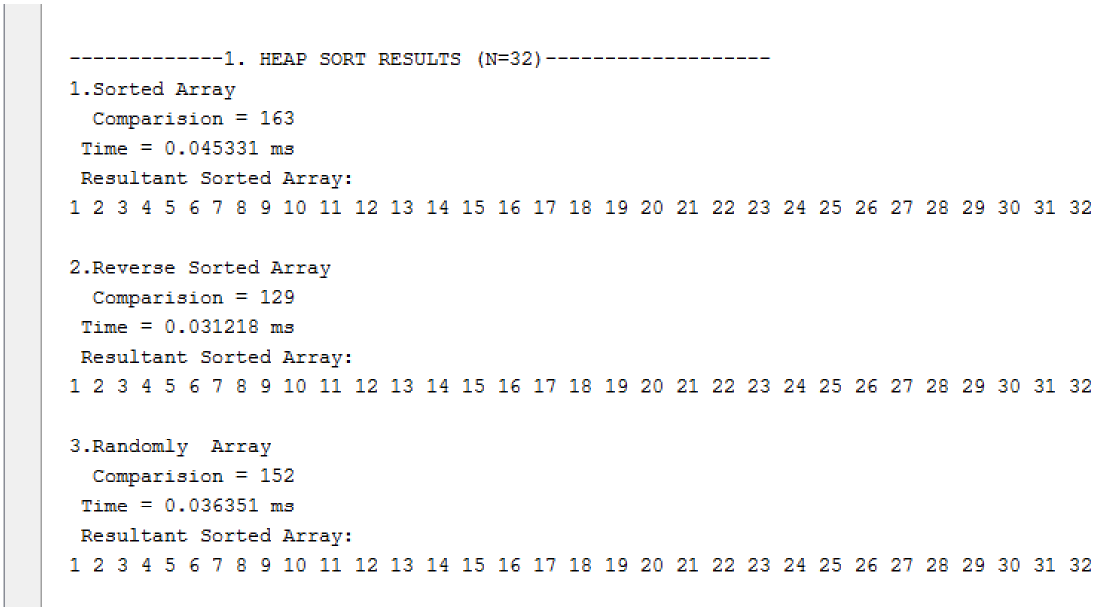


```
-------------1. MERGE SORT RESULTS (N=32)-------------------
1.Sorted Array
COMPARISION = 80
 Time = 0.109479 ms
 Resultant Sorted Array:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

2.Reverse Sorted Array
COMPARISION = 80
 Time = 0.050891 ms
 Resultant Sorted Array:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

3.Randomly Generated Array
COMPARISION = 122
 Time = 0.05645 ms
 Resultant Sorted Array:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
```

3) Heap Sort Result- In below result for heap 1. Shows the Best Case, 2. Shows the Worst Case, 3. Shows the Average case

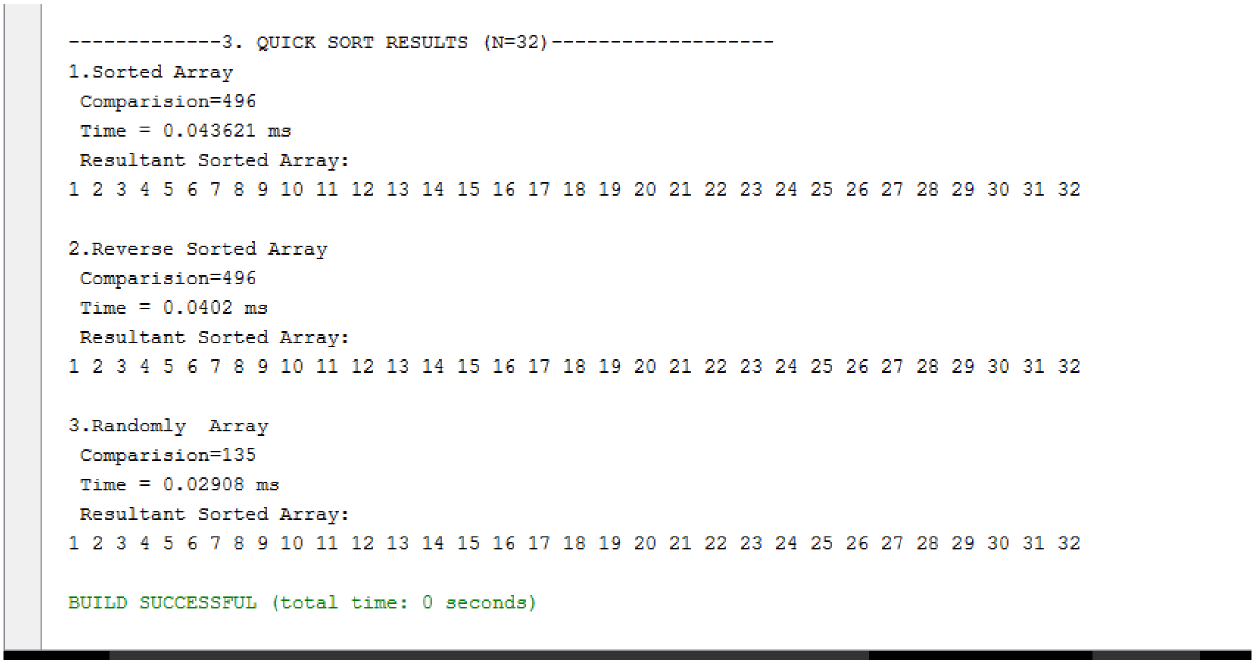


```
-------------1. HEAP SORT RESULTS (N=32)-------------------
1.Sorted Array
  Comparision = 163
 Time = 0.045331 ms
 Resultant Sorted Array:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

2.Reverse Sorted Array
  Comparision = 129
 Time = 0.031218 ms
 Resultant Sorted Array:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

3.Randomly  Array
  Comparision = 152
 Time = 0.036351 ms
 Resultant Sorted Array:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
```

4) Quick Sort Result- In below result for quick 1. Shows the Best Case, 2. Shows the Worst Case, 3. Shows the Average case



```
-------------3. QUICK SORT RESULTS (N=32)-------------------
1.Sorted Array
 Comparision=496
 Time = 0.043621 ms
 Resultant Sorted Array:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

2.Reverse Sorted Array
 Comparision=496
 Time = 0.0402 ms
 Resultant Sorted Array:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

3.Randomly  Array
 Comparision=135
 Time = 0.02908 ms
 Resultant Sorted Array:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

BUILD SUCCESSFUL (total time: 0 seconds)
```

TABULATED RESULT

a. Comparisons

SORTING ALGO	Sorted	Rev. Sorted	Random
MERGE	80	80	122
HEAP	163	129	152
QUICK	496	496	135

b. Time in ms

SORTING ALGO	Sorted	Rev. Sorted	Random
MERGE	0.109479	0.050891	0.05645
HEAP	0.045331	0.031218	0.036351
QUICK	0.043621	0.0402	0.02908

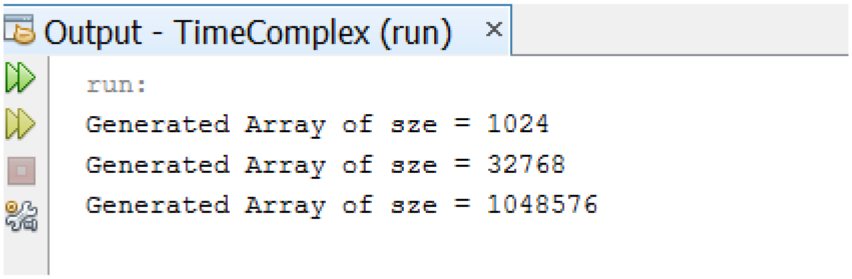
2) ANALYSIS OF LARGE SIZE ARRAY

NOTE:

- Run “TimeCompex.java”
- TimeComplex.java takes longer time to run.
- No external Input to be provided.

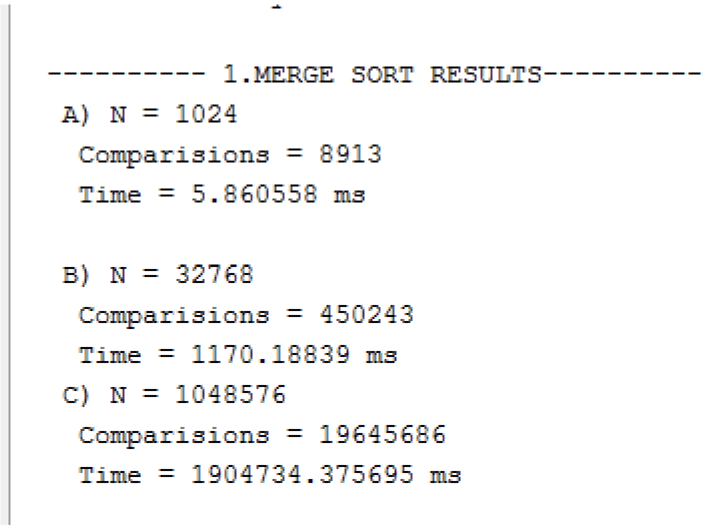
O/p snaps:

a) TimeCompex.java o/p three generated array. Array of size 1048576 takes large time to compute.



```
run:
Generated Array of sze = 1024
Generated Array of sze = 32768
Generated Array of sze = 1048576
```

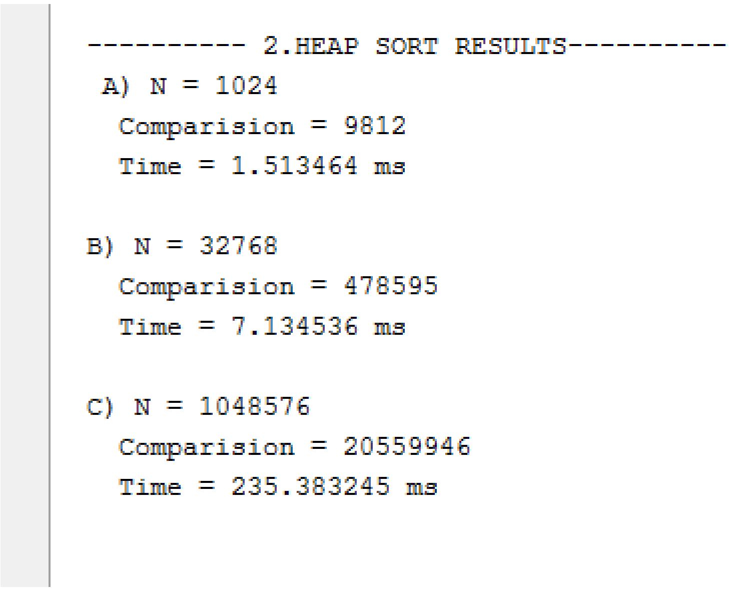
b)



```
---------- 1.MERGE SORT RESULTS----------
 A) N = 1024
  Comparisions = 8913
  Time = 5.860558 ms

 B) N = 32768
  Comparisions = 450243
  Time = 1170.18839 ms
 C) N = 1048576
  Comparisions = 19645686
  Time = 1904734.375695 ms
```

c)

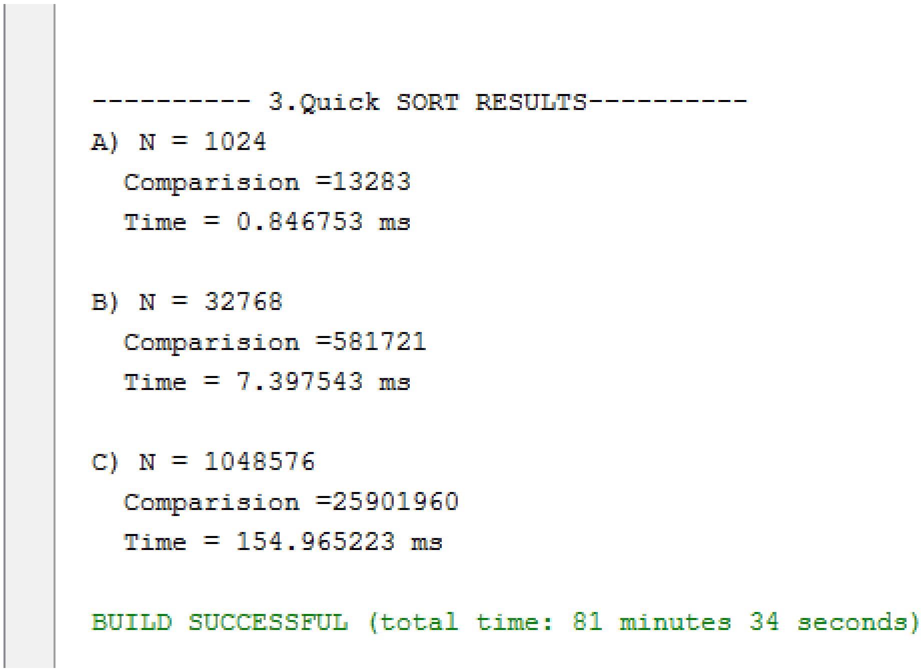


```
---------- 2.HEAP SORT RESULTS----------
 A) N = 1024
  Comparision = 9812
  Time = 1.513464 ms

B) N = 32768
  Comparision = 478595
  Time = 7.134536 ms

C) N = 1048576
  Comparision = 20559946
  Time = 235.383245 ms
```

d)



```
---------- 3.Quick SORT RESULTS----------
A) N = 1024
  Comparision =13283
  Time = 0.846753 ms

B) N = 32768
  Comparision =581721
  Time = 7.397543 ms

C) N = 1048576
  Comparision =25901960
  Time = 154.965223 ms

BUILD SUCCESSFUL (total time: 81 minutes 34 seconds)
```

TABULATED RESULT

1) COMPARISIONS.

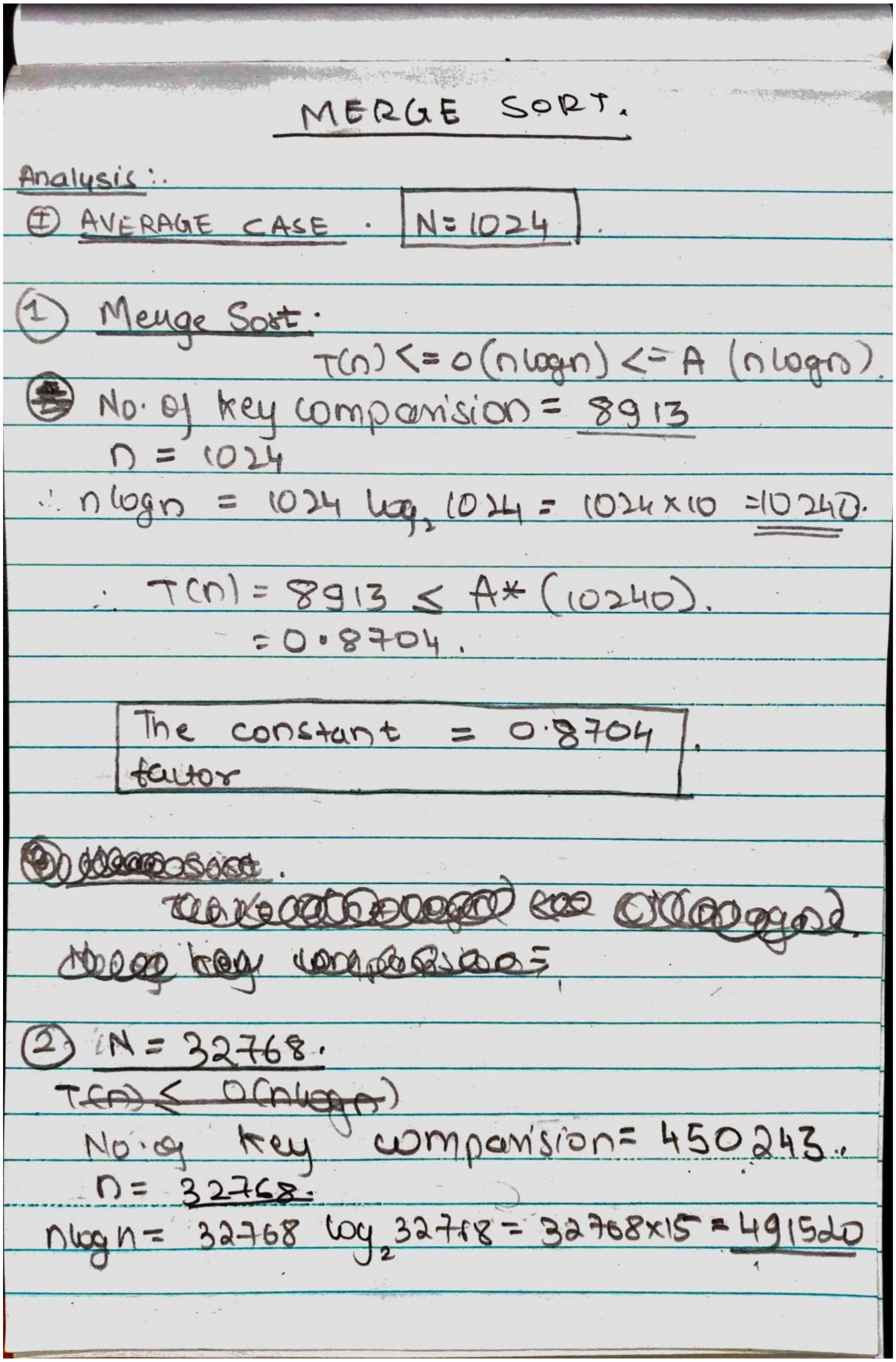
SORTING ALGO	**N= 1024**	**N=32768**	**N=1048576**
MERGE	8913	450243	19645686
HEAP	9812	478595	20559946
QUICK	13283	581721	25901960

2) TIME (in ms)

SORTING ALGO	**N= 1024**	**N=32768**	**N=1048576**
MERGE	5.860558	1170.18839	1904734.375695
HEAP	1.513464	7.134536	235.383245
QUICK	0.846753	7.397543	154.965223

Analysis

1)



MERGE SORT.

Analysis :.

① AVERAGE CASE . $\boxed{N = 1024}$.

① Merge Sort:

$T(n) <= o(n\log n) <= A\,(n\log n)$.

No. of key comparision = 8913

$n = 1024$

$\therefore n\log n = 1024 \log_2 1024 = 1024 \times 10 = 10240$.

$\therefore T(n) = 8913 \leq A * (10240)$.

$= 0.8704$.

$\boxed{\text{The constant factor} = 0.8704}$.

② $N = 32768$.

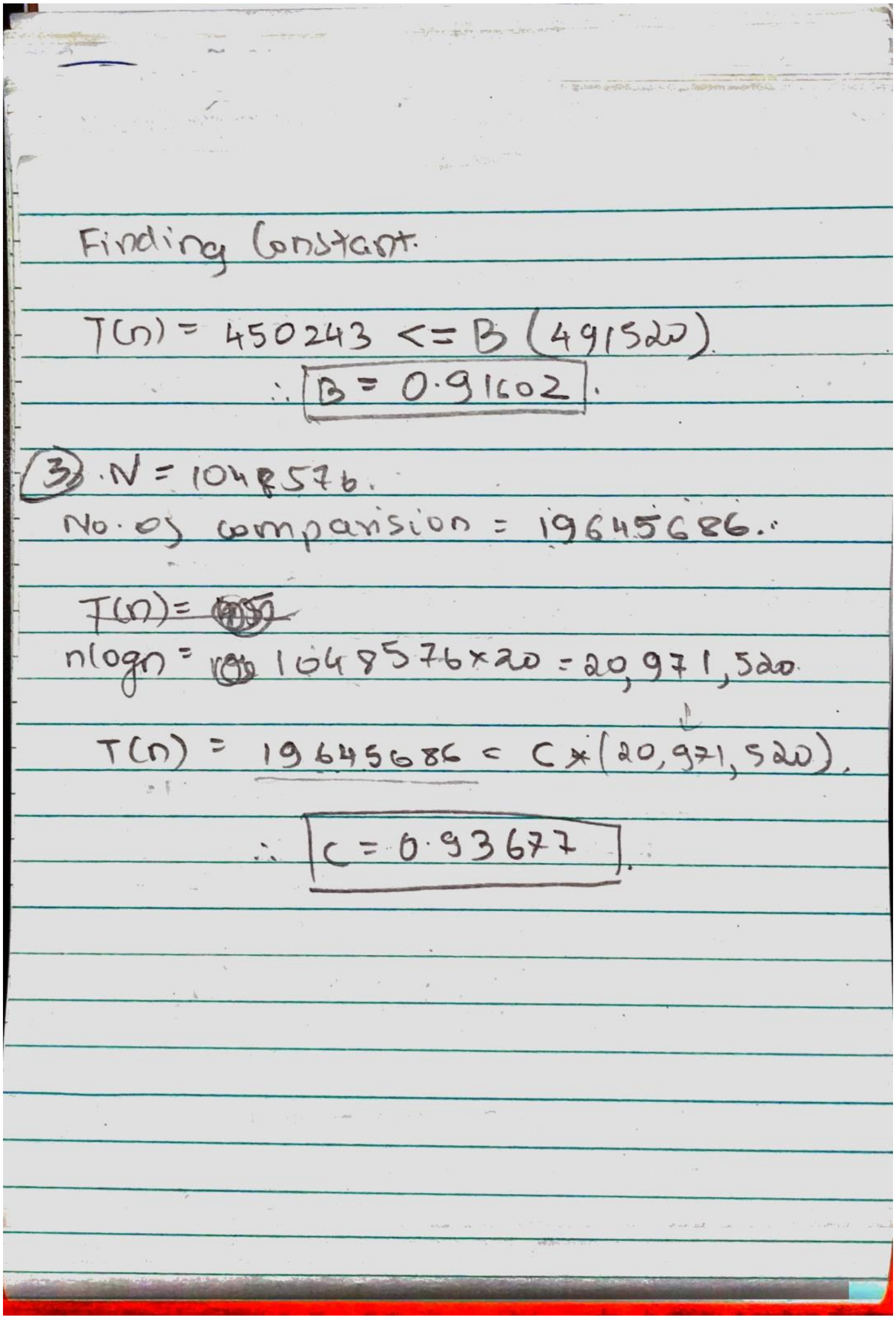
~~$T(n) \leq O(n\log n)$~~

No. of key comparision = 450243.

$n = 32768$.

$n\log n = 32768 \log_2 32768 = 32768 \times 15 = 491520$

2)



Finding Constant.

$T(n) = 450243 <= B\,(491520)$.

$\therefore \boxed{B = 0.91602}$.

(3) . $N = 1048576$.

No. of comparision = 19645686.

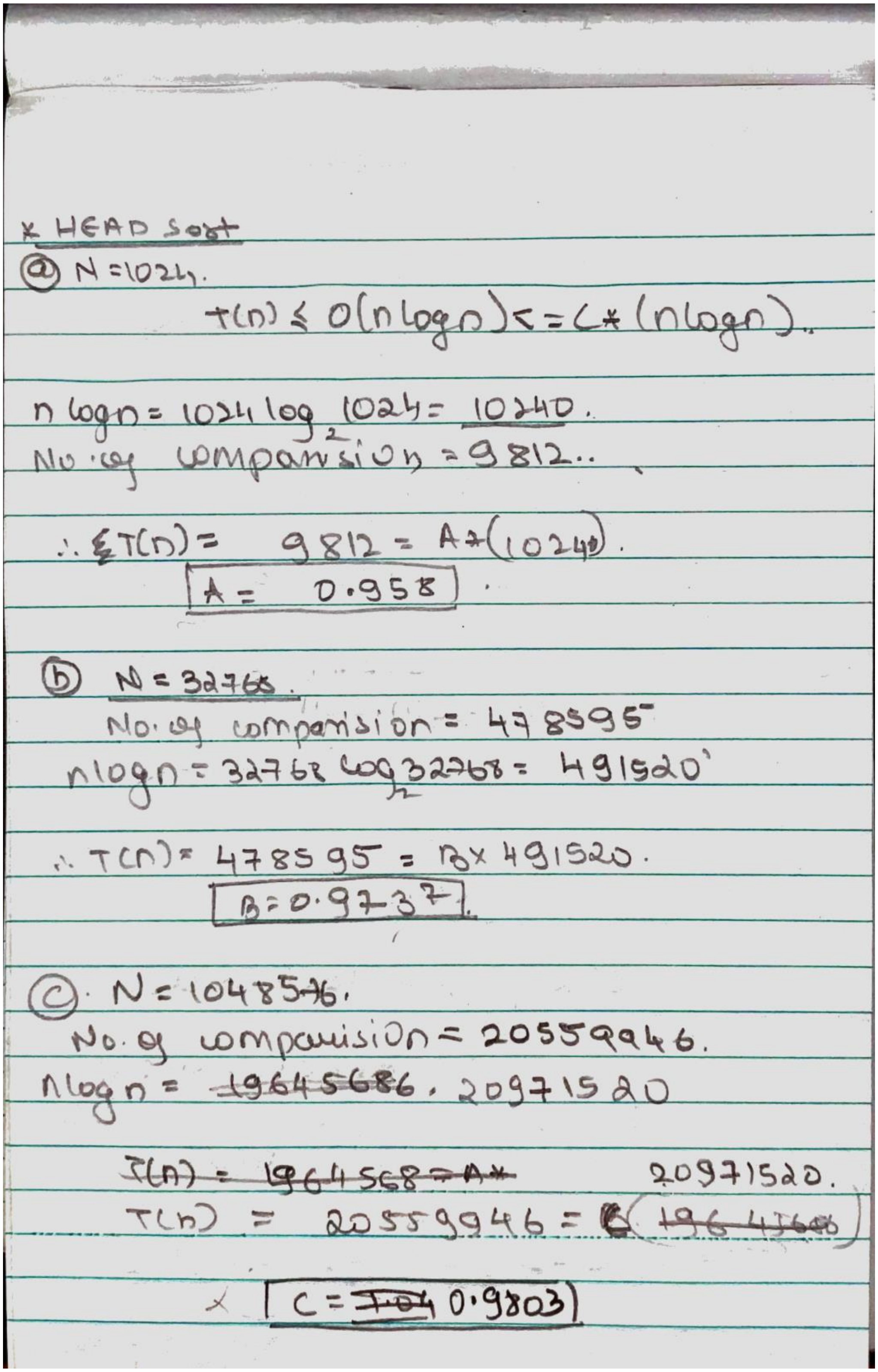
~~$T(n) =$~~

$n\log n = 1048576 \times 20 = 20,971,520$.

$T(n) = 19645686 = C * (20,971,520)$.

$\therefore \boxed{C = 0.93677}$.

3)



* HEAD Sort

ⓐ N =1024.

T(n) ≤ O(n logn) <= C* (nlogn).

n logn = 1024 $\log_2$ 1024 = 10240.

No. of comparision = 9812..

∴ ΣT(n) = 9812 = A*(10240).

$\boxed{A = 0.958}$.

ⓑ N = 32768.

No. of comparision = 478595

nlogn = 32768 $\log_2$ 32768 = 491520

∴ T(n) = 478595 = B× 491520.

$\boxed{B = 0.97337}$.

ⓒ. N = 1048576.

No. of comparision = 20559946.

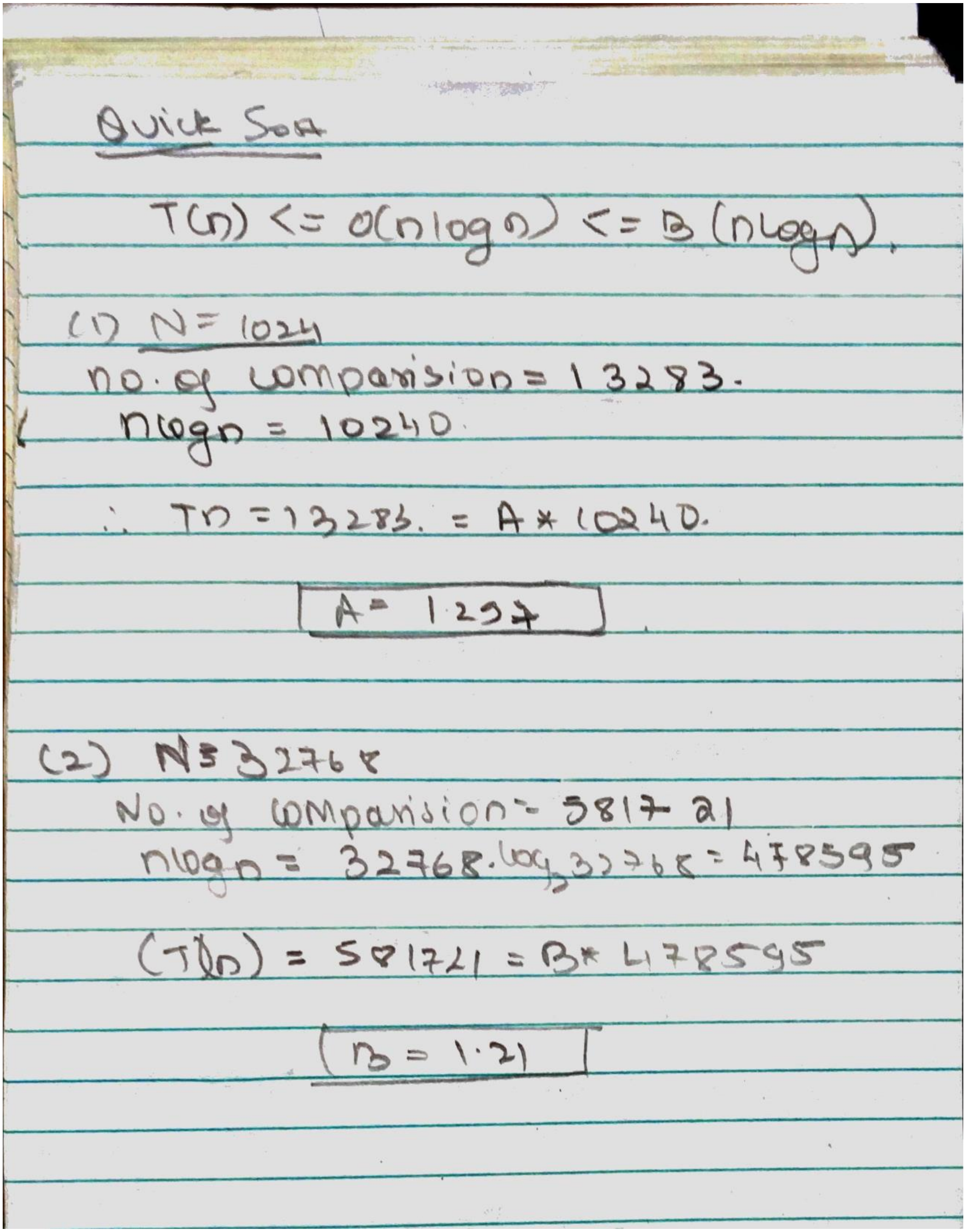
nlogn = ~~19645686~~. 20971520

~~T(n) = 1964568 = A*~~ 20971520.

T(n) = 20559946 = C(~~19645686~~)

× [C = ~~1.04~~ 0.9803]

4)



Quick Sort

$T(n) <= O(n\log n) <= B(n\log n)$.

(1) N = 1024

no. of comparision = 13283.

$n\log n$ = 10240.

∴ Tn = 13283. = A * 10240.

$\boxed{A = 1.297}$

(2) N = 32768

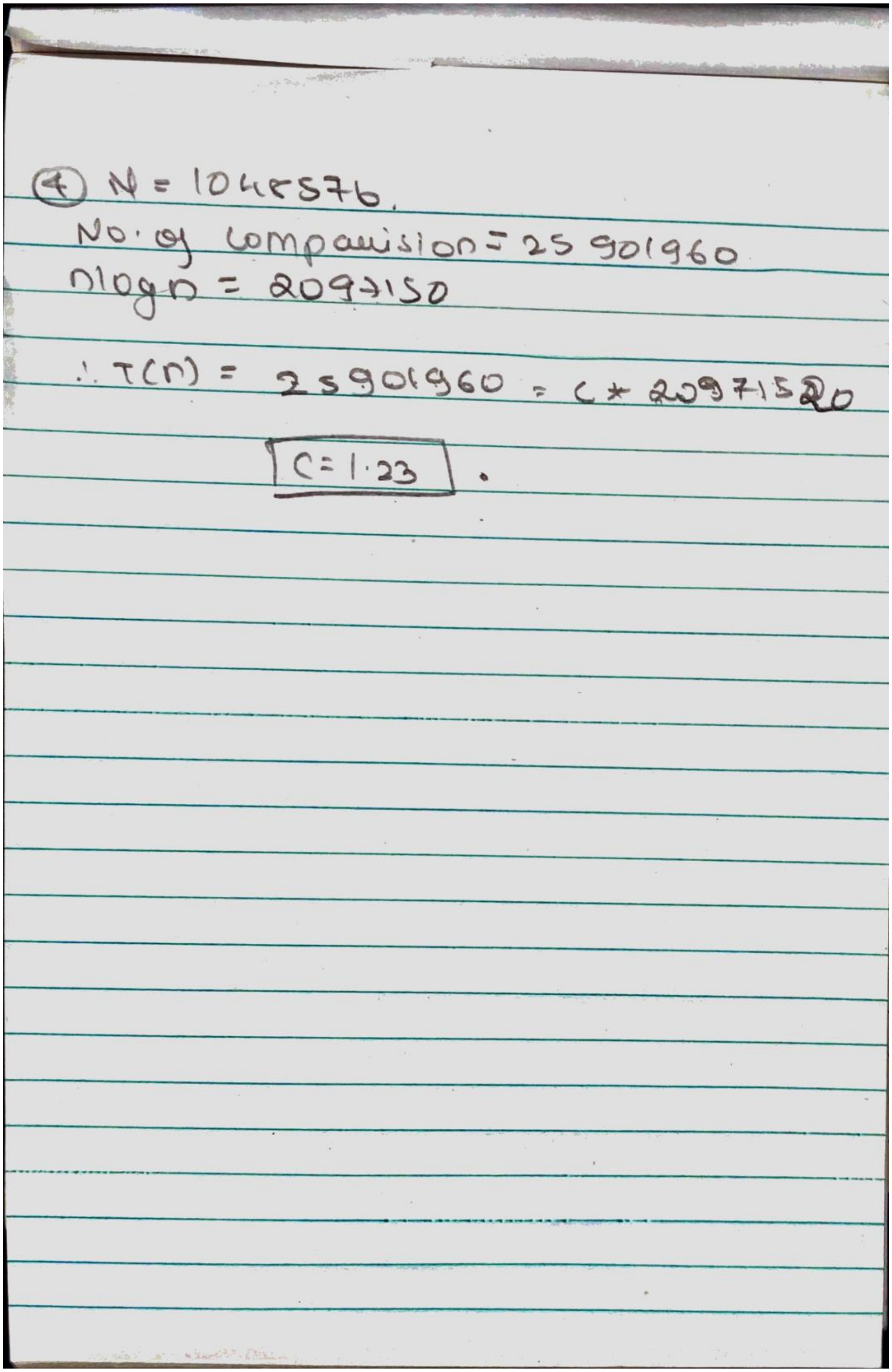
No. of comparision = 581721

$n\log n$ = $32768 \cdot \log_2 32768$ = 478595

(T(n)) = 581721 = B* 478595

$\boxed{B = 1.21}$

5)



(4) N = 1048576.

No. of comparision = 25901960

nlogn = 2097150

$\therefore T(n) = 25901960 = c * 20971520$

$\boxed{c = 1.23}$.