**Course: Algorithm  
Prof. Prem Nair  
Student: Binh Van Tran  
ID: 986648  
Homework: Lab 7**

1. **Question 1 –** Practice Radix Sort {179, 721, 639, 549, 292, 427, 335, 435, 62} with radix is 9

|  |  |  |
| --- | --- | --- |
| **Key % 9** | **(Key /9) % 9** | **Key / 9 /9** |
| 0: 639; 549 | 335; 179 | 62 |
| 1: 721 |  |  |
| 2: 335 | 427 | 179 |
| 3: 435 | 435 | 292 |
| 4: 292; 427 |  | 335 |
| 5: | 292 | 427; 435 |
| 6: | 62 | 549 |
| 7: | 549 | 639 |
| 8: 179; 62 | 639; 721 | 721 |

1. **Question 2 -** Experimenting with lower bound

As the theorem of lower bound in compared-based sorting algorithm we have

For an input of *n* elements, the representative decision tree **T** has

**T** has n! leaves

Height of the tree: h >= *log(n!*)

Number of comparisons: >= *log(n!)*

In this question, we have n = 4, so the number of comparisons should be at least log(4!) = 3 + log3 = 4.5 is the lower bound of comparisons that the algorithm need to make.

5 of comparisons is a proper value, therefore this doesn’t violate the theoretical lower bound.

1. **Exploring new ideas**: Forward and backward sorted array (FBS array)

* Step 1: Sort the array ascendingly
* Step 2: Reverse the values at the odd indexes descendingly
* Step 3: Put even index value & odd index value in right order

of *n* integers

As we can see:

Step 1: QuickSort take *nlogn*

Step 2: take *n/2*

Step 3: take *n2/4*

Step 1 + Step 2 + Step 3 = *nlogn + n/2 + n2/4*

So, we can say time complexity is *O(n2)*

Better solution in term of time complexity:

Take 1 more array with the same size of the input

Copy from input to additional array

of *n* integers