

# Recitation Note - CS430 Fall 2014

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- This is my personal note for the recitation, and it may contain some error. Please let me know if you find one (or more).
- I do not guarantee I will prepare a note for every recitation.
- In this recitation, I will discuss the correctness and complexity of counting sort, radix sort, and bucket sort.
- Some obvious results are not described in the note.

## 1 Correctness of radix sort.

### Base case

When the numbers are single digit numbers (length = 1), the sorting algorithm used in radix sort will sort the numbers correctly.

### Inductive hypothesis

When the numbers are  $k$ -digit numbers (length =  $k$ ), radix sort will sort the numbers correctly.

### Inductive step & proof

When the numbers are  $(k + 1)$ -digit numbers (length =  $k + 1$ ), we already know the previous  $k$  digits are sorted correctly due to the above hypothesis. After we use the stable sorting algorithm to sort the  $(k + 1)$ -th digits of the numbers, because of the stable sorting algorithm, we have the following property for any two numbers with the same  $k + 1$ -th digit: the number having smaller number in the first  $k$  digits will be placed in front of the other one. Therefore, the numbers of  $k + 1$  bits will be sorted correctly.

### Conclusion

Combining the above, we can conclude the radix sort will sort numbers of any digit length correctly.

## 2 Expected complexity of bucket sort.

Textbook page 201-203.