

Lab 6

1. Show that any comparison-based algorithm to sort 4 elements requires at least 5 comparisons in the worst case.
2. Carry out the steps of RadixSort to sort the following {80, 27, 72, 1, 27, 8, 64, 34, 16} – Hint: use 9 for your radix.
3. Describe an $O(n)$ algorithm that does the following: Given an input array of n integers lying in the range $0 \dots 3n - 1$, the algorithm outputs the first integer that occurs in the array only once. (You may assume that each input array contains at least one number that has no duplicates in the array.) Explain why your algorithm has an $O(n)$ running time.
Example: If the input array is [1, 2, 4, 9, 3, 2, 1, 4, 5], then the return value is 9 since 9 is the first integer that occurs in the array only once.
4. The Fibonacci numbers are defined in the following way:
 $F(0) = 0, F(1) = 1, F(n) = F(n-1) + F(n-2)$
 - a. Devise a recursive algorithm for computing the n th Fibonacci number.
 - b. Can you use one of the techniques in lesson 2 to compute the running time of your recursive algorithm?
 - c. Devise an iterative algorithm for computing the n th Fibonacci number.
 - d. What is the running time of your iterative algorithm?