Lab Sheet 2

Sorting, Recursion and Bit manipulation

Write Recursive programs for solving the following problems.

1. Print the first N natural numbers.
2. Print the first N natural numbers in reverse order.
3. Print the product of the first N natural numbers.
4. Print the N^{th} Fibonacci number.
5. Calculate x^y.
6. Find the GCD(HCF) of two numbers.
7. Print the elements of an array.
8. Print the elements of an array in reverse order.
9. Reverse a given number.
10. Check if an array is sorted or not.
11. Write a recursive algorithm to find the median of an array in O(n) time.
12. Write a recursive algorithm to find the k^{th} largest element in an array.

Implement the following sorting algorithms and answer the associated questions.

13. Bubble sort
    a. What is the time complexity of a simple bubble sort algorithm? Is there any difference between the best case and the worst case?
    b. How can we change the best-case complexity to Ω(n)? Modify your algorithm accordingly. What is the worst-case complexity of the improved algorithm?
    c. Give examples for best-case and worst-case inputs.

14. Selection sort
    a. What is the time complexity of a simple selection sort algorithm? Is there any difference between the best case and the worst case?
    b. How can we change the best-case complexity to Ω(n)? Modify your algorithm accordingly. What is the worst-case complexity of the improved algorithm?
    c. Give examples for best-case and worst-case inputs.

15. Insertion sort
    a. What is the time complexity of a simple selection sort algorithm? Is there any difference between the best case and the worst case?
    b. How can we change the best-case complexity to Ω(n)? Modify your algorithm accordingly. What is the worst-case complexity of the improved algorithm?
    c. Give examples for best-case and worst-case inputs.

Bit manipulation is a fundamental computer science concept useful for writing efficient code. Learn the fundamentals by solving the following problems. While uploading the solutions, you must keep the screenshot of your successful submission in geeksforgeeks.

These questions were given as part of the vacation assignment. If you have already solved these, you can use the screenshot from your previous submission.

16. Get i^{th} bit, Set i^{th} bit, Clear i^{th} bit - https://www.geeksforgeeks.org/problems/bit-manipulation-1666686020/1
17. Count number of set bits - https://www.geeksforgeeks.org/problems/count-total- set-bits-1587115620/1
18. Check odd and even - https://www.geeksforgeeks.org/problems/odd-or-even3618/1