International Institute of Information Technology, Bangalore
EG102 Data Structures and Algorithms Lab.

1. Let $F(0) = 0, F(1) = 1$ and $F(n) = (F(n-1) + F(n-2))\%m$. Implement the algorithm to compute $F(n)$, by finding the period of the sequence. $1 < n < 10^{10^5}, 10 < m < 10^6$.

2. Let $F(0) = 0, F(1) = 1, F(2) = 2$ and $F(n) = (F(n-1) + F(n-3))\%m$. Implement the algorithm to compute $F(n)$, using the matrix multiplication method . $1 < n < 10^{10^5}, 10 < m < 10^6$.

3. Implement MergeSort, QuickSort and FindRank algorithms.

4. Given an array of integers, $a_0, a_1, a_2, \ldots a_{n-1}$, we would like to know, if there are three numbers such that sum of two numbers is equal to the third number. That is if there is i, j, k such that $a_i + a_j = a_k$. Give an $O(n^2)$ algorithm to solve this problem.

5. Let $a_1, a_2, \ldots a_n$ be a sequence of distinct numbers. The pair (i, j) is called a inversion, if $i < j$ and $a_i > a_j$. Write an $O(n \log n)$ algorithm to determine the number of inversions in the given array.

6. You are given a sequence of $10 < n < 10^9$ numbers and a number $10 < k < 10^5$ such that, $1 \leq k \leq n$. Write an efficient algorithm to list the k smallest numbers among the given sequence of numbers. What is the complexity of the algorithm ?