Assignment 6 (Recursive Algorithms)

Question 1

Implement in C++ and Java three sorting algorithms, including the merge-sort and quick-sort algorithms, and compare the implementations on CPU time using three different inputs.

Question 2

Write a function that counts the number of n-letter words of the alphabet $\Sigma = \{a, b\}$ that do not contain the string $aa$; use dynamic programming to speed-up the function.

Question 3

Write a function that returns a list of all of the n-element subsets of a given set. For example, if the given set is $\{1, 2, 3\}$ and n is 2, then the returned list should contain $\{1, 2\}$, $\{1, 3\}$, and $\{2, 3\}$. The order of the elements is not important.

Question 4 (Sudoku)

Given an $9 \times 9$ board with some squares already filled with hint values, the objective of the Sudoku problem is to fill all the empty squares with values in 1..9, such that each row, each column, and each of the 9 blocks are filled with distinct values. Write a program in C++ or Java that solves the following Sudoku instance:

$$A = \{\{5, 3, _, _, 7, _, _, _, \},$$
$$\{6, _, _, 1, 9, 5, _, _, \},$$
$$\{_, 9, 8, _, _, _, 6, _, \} ,$$
$$\{8, _, _, 6, _, _, _, 3\},$$
$$\{4, _, _, 8, _, 3, _, _, 1\},$$
$$\{7, _, _, 2, _, _, _, 6\},$$
$$\{_, _, _, 2, _, _, _, 6\},$$
$$\{_, _, _, _, _, _, _, _, \},$$
$$\{_, _, _, _, _, _, _, _, \}\}.$$