

1. Eight symbols $A, B, C, D, E, F, G,$ and H are possibly transmitted on a communication channel where the frequencies of the transmissions of these symbols are 2, 3, 6, 7, 9, 10, 19, and 44, respectively. Please design **Huffman codes** for the eight symbols and calculate the average code length. (25%)
2. [10%] Please sort 12, 20, 18, 10, 9, 13, and 11 by the **quick sort** algorithm. (Show your answer in details). (25%)
3. [20%] The satisfiability (**SAT**) problem is NP-complete. Please prove that the 3-satisfiability (**3-SAT**) problem is NP-complete, too. (25%)
4. [25%] Input a positive number N and a parameter m . Please design a **polynomial-time randomized algorithm** to test if N is a prime with the probability of correctness being at least $1-2^{-m}$. (25%)