**Problem 1.** Suppose that $\xi, \eta$ are two random variables and there exists a function $F$ such that

$$P(\xi \le x, \eta \le y) = F(x \wedge y).$$

Discuss the relation between $\xi$ and $\eta$.

**Problem 2.** Let $\xi$ be a standard Gaussian random variable. Prove that there exists $C > 0$ such that

$$\left(\mathbb{E}|\xi|^p\right)^{\frac{1}{p}} \le C\sqrt{p}, \qquad \forall\, p > 1.$$

**Problem 3.** To order $n$ random natural numbers $\{x_1, x_2, \cdots, , x_n\}$ according to their magnitudes, pick randomly a number $x$ from $\{x_1, x_2, \cdots, x_n\}$, comparing all other numbers with $x$, place the smaller ones to the left of $x$, and the bigger ones to the right of $x$. Repeating the above procedure for the numbers to the left and right of $x$, respectively, $\cdots$, until the numbers $\{x_1, x_2, \cdots, x_n\}$ are placed in an increasing order as $x_{(1)} < x_{(2)} < \cdots < x_{(n)}$. Using probabilistic argument (e.g., conditional expectation) to evaluate roughly the average number of steps (each step is a comparing of two numbers) needed to complete the task for large $n$.