Problem 1. Let \((\Omega, \mathcal{F}, \mathbb{P})\) be a probability space and \(\mathcal{G} \subset \mathcal{F}\) a sub-\(\sigma\)-algebra. Let \(X, Y \in L^1(\mathcal{F}, \mathbb{P})\) with \(XY \in L^1(\mathcal{F}, \mathbb{P})\) and assume that \(X\) is also \(\mathcal{G}\)-measurable. Show that \(\mathbb{E}[XY|\mathcal{G}] = X\mathbb{E}[Y|\mathcal{G}]\).

Problem 2. Understand and reproduce the proof of the one-dimensional Itô formula.

Problem 3. Check in detail the complex Itô formula.