1. **7 marks** Assume the rewards are 1-subgaussian and there are $k \geq 2$ arms. The $\epsilon$-greedy algorithm depends on a sequence of parameters $\epsilon_1, \epsilon_2, \ldots$. First it chooses each arm once and subsequently chooses $A_t = \arg \max_i \hat{\mu}_i(t - 1)$ with probability $1 - \epsilon_t$ and otherwise chooses an arm uniformly at random. Prove that if $\epsilon_t = \epsilon > 0$, then $\lim_{T \to \infty} \frac{R_T}{T} = \frac{\epsilon}{k} \sum_{i=1}^{k} \Delta_i$.

2. **3 marks** Let $X_1, X_2, \ldots$ be a sequence of independent standard Gaussian random variables defined on probability space $(\Omega, \mathcal{F}, \mathbb{P})$. Suppose that $T : \Omega \to \{1, 2, 3, \ldots\}$ is another random variable, and let $\hat{\mu} = \frac{1}{T} \sum_{t=1}^{T} X_t$ be the empirical mean based on $T$ samples. Show that if $T$ is independent from $X_t$ for all $t$, then $\mathbb{P}\left(\hat{\mu} - \mu \geq \sqrt{\frac{2 \log(1/\delta)}{T}}\right) \leq \delta$. 