Source task and conventions

Compare the two bounds and produce the requested $\varepsilon = .05$ plot.

Conventional solution and proof

As printed, the source assumes only common mean and variance. Independence is needed for the usual $1/m$ variance reduction and Hoeffding product argument. Indeed, setting every $X_i = B$ for one Bernoulli(1/2) variable gives $P(|\bar{X} - 1/2| > .05) = 1$ for every m, contradicting the proposed exponential decay. The following solves the intended independent bounded-variable version explicitly.

(a) Independence gives $\operatorname{Var} \bar{X} = \sigma^2/m$. Markov's inequality applied to $(\bar{X} - \mu)^2$ gives

$$P(|\bar{X} - \mu| > \varepsilon) \le \min\{1, \sigma^2/(m\varepsilon^2)\}.$$