

▷ **Aufgabe 5 (Weak law of large numbers)** (6 scores)

Let $X := \frac{1}{N} \sum_i Y_i$, where the Y_i are N independent random variables Y_1, \dots, Y_N , having common mean \bar{Y} and common variance σ_Y^2 . Then

$$\text{Prob}((X - \bar{Y})^2 \geq \alpha) \leq \frac{\sigma_Y^2}{\alpha N} \quad (4)$$

Describe in words where – for N sufficiently large – the distribution of the X is concentrated, and what is its width.

▷ **Aufgabe 6 (Berlin or Potsdam)** (π scores)

Imagine yourself in any of two cities B or P , not knowing which city you are in. You know however, that all citizens of B are consistent liars, and all citizens of P are consistent in telling the truth. Unfortunately, citizens can freely commute between B and P , so its hard to tell whom you are talking to.

- (a) What is your initial level of ignorance about the city you are in?
- (b) How can you find out which city you are in?
- (c) How can you find out whom you are talking to?

Analyse the complexity of you interrogation in terms of Shannon entropies.