Information Theory **DCC/ICEx/UFMG**
Prof. Mário S. Alvim **2024/1**

PROBLEM SET

Probability, Entropy, and Inference / More About Inference
(MacKay - Chapter 2 / Chapter 3)

Necessary reading for this assignment:

- *Information Theory, Inference, and Learning Algorithms* (MacKay):

  Chapter 2

  - Chapter 2.1: *Probabilities and ensembles*
  - Chapter 2.2: *The meaning of probability*
  - Chapter 2.3: *Forward probabilities and inverse probabilities*

  Chapter 3

  - Chapter 3.2: *The bent coin*
  - Chapter 3.3: *The bent coin and model comparison*
  - Chapter 3.4: *An example of legal evidence*

Note: The exercises are labeled according to their level of difficulty: `[Easy]`, `[Medium]` or `[Hard]`. This labeling, however, is subjective: different people may disagree on the perceived level of difficulty of any given exercise. Don't be discouraged when facing a hard exercise, you may find a solution that is simpler than the one the instructor had in mind!

Review questions.

1. `[Easy]` Answer formally the following questions:

   (a) Describe succinctly the two most common interpretations of probability: the *frequentist* interpretation, and the *Bayesian* interpretation.

   (b) Define the concepts of *forward probability* and of *inverse probability*.

   (c) What is the difference between the terms *likelihood* and *probability*? In what situation should each of them be used?

Problems (Chapter 2).

2. (MacKay 2.30) `[Medium]`

3. (MacKay 2.37) `[Medium]`

Problems (Chapter 3).

4. (MacKay 3.11) `[Medium]`

5. (MacKay 3.12) `[Medium]`