Entropy:
1) How much information in bits is represented by a clock with hour and minute hand?

2) You have a compass.
   a) Assume you implement a binary classifier based on the direction of the compass needle. What is the maximum amount of information in bits that this compass classifier can represent?
   b) How could you modify your compass classifier to represent less information?
   c) Instead of a binary classifier, you implement a general classifier. What is the maximum amount of information in bits you can train your compass to represent as a function of the number of thresholds?

Neurons:
3) Show that the maximum output of a threshold neuron is maximally one bit, independent of the activation function. Hint: Do exercise 2 first.

4) Boolean functions.
   a) Draw the decision tree for the NAND function of two boolean inputs.
   b) Draw an artificial neuron that implements NAND for two boolean inputs.
   c) Draw a three-neuron artificial neural network that implements equality for two boolean inputs.
   d) Draw a two-neuron artificial neural network that implements equality for two boolean inputs.
   e) How do you have to change b) for non-boolean inputs?

5) Show by induction that \( T(2n,n) = 0.5T(n,n) \). (The \( T(n,k) \) function is defined in MacKay’s book, Chapter 40).

6) Describe a process to black-box benchmark practical implementations of neural networks based on the \( T(n,k) \) function.