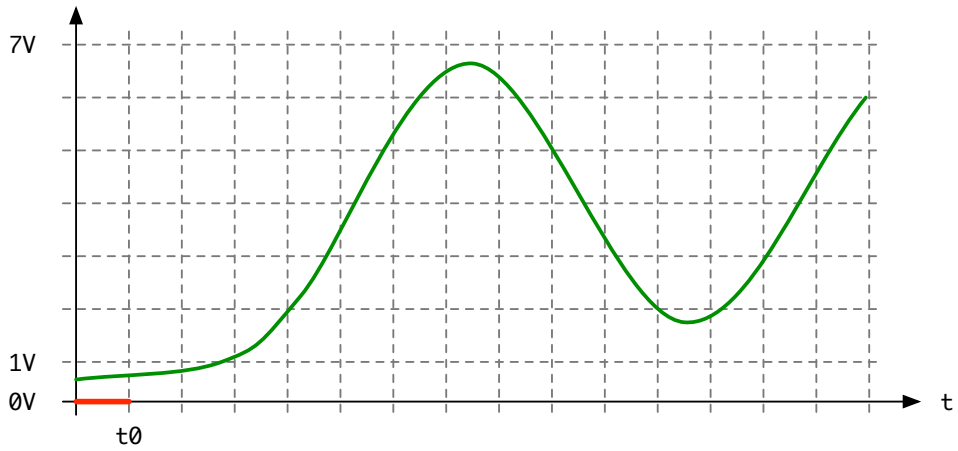
Ex. 1: Digitalization

1. Explain Nyquist's theorem.
2. What happens if the sampling done with a lower frequency?
3. Describe the quantization of a given signal. As the discretization of time, quantization can be done using equally spaced intervals. Name the disadvantages of this approach and explain an alternative.
4. In the last step of the digitalization, any quantization interval is assigned to a binary code word. Name and describe a coding scheme that is commonly used for audio.
5. Name some advantages of digital audio transmissions compared to analog transmissions.

Ex. 2: Signal Coding

Let S be an analog signal varying between 0 [voltage] and 7 V (Volts) with 1V being the smallest resolution.



1. How many bits are necessary to encode a single sample?
2. How many bits are necessary to encode a single sample using delta modulation?
3. Encode S using delta modulation. Sketch your results into the figure above.
4. What are the drawbacks of this coding scheme?
5. Find an optimal code, i.e. a code with the minimum possible number of bits, that represents S best concerning the signal deviation.

Ex. 3: Multiplexing

Solve Exercise 2 of WS 04/05.
`http://www.informatik.uni-mannheim.de/pi4/info/examination/`

Ex. 4: xDSL

1. Name and explain advantages of ADSL. Also compare it to a classical Modem.
2. Why is ADSL asymmetric? Give some reasons.
3. Explain why the bandwidth of ASDL varies over time. Name the factors that influence this variation. How does ADSL handle this?
4. How are those high data rates achieved by xDSL?
5. Consider a 1200 baud modem. In case of QAM with 4 data points, what is the maximal data rate?
6. Compare the two approaches CAP (Carrierless Amplitude/Phase Modulation) and DMT (Discrete Multitone Modulation). What is the main advantage of DMT?
7. Solve the exam question 2(a) of WS 05/06.
   `http://www.informatik.uni-mannheim.de/pi4/info/examination/`.