

Embedded Systems

Please indicate your **name**, **matriculation number**, **email address**, and which **discussion session** you have been allocated to. We encourage you to collaborate in **groups** of up to **three** students. Only one submission per group is necessary.

Problem 1 (Sampling)

Assume that we have an input signal consisting of the sum of two sine waves of 1.75kHz and 2kHz. What is the minimal sampling rate to enable the reconstruction of the signal and what are the limiting factors for reconstructing continuous signals in practice?

Problem 2 (A/D and D/A Converters)

- (a) Extend the flash-based A/D converter such that it can be used for negative voltages as well.
- (b) Develop the schematic of a 3-bit D/A-converter. The conversion should be done for a 3-bit vector x encoding numbers as two's complement.

Problem 3 (Power Management)

Develop a hybrid automaton that models the energy consumption of an embedded processor (e.g. in a cell phone or in a pacemaker). The graphics below describes its different levels of activity, which correspond to different levels of energy consumption, and the timing constraints of switching from one states to the next. Furthermore, your model should include that the processor can only use an initially given charge E_{init} provided by its battery. You may assume additional signals that initiate the change activity levels.

