Questions concerning topics from Lecture 1:

• Discrete deterministic signal (time-domain notation)

• Discrete system

• Elemental signals and their notation (unitary pulse, unitary step, complex exponential)

• Basic signal manipulations (shift, reversal, resampling)

• Properties of discrete systems (memoryless, causal, stable, linear, shift/time-invariant)

• LTI system and his models in time-domain (difference equation, impulse response)

• Convolution of discrete signals (meaning, properties)

Questions concerning topics from Lecture 2:  
• Solving of difference equations – describe the process, what is the goal,  
what methods are known.  
• Auto-correlation/cross-correlation of deterministic signals (meaning,  
properties)  
• Signal energy/ signal power (meaning, computation)  
• Discrete-time Fourier Transform (DTFT, notation, properties)  
• DTFT spectrum of signal (meaning, properties

Questions concerning topics from Lecture 3:  
• DTFT spectrum – digital frequency (meaning, boundary values)  
• Frequency response (meaning, notation, periodicity, symmetry)  
• Response of LTI system on a signal (LTI given by difference equation -  
LCCDE, impulse response - IR, frequency reponse - FR)  
• Relations among LTI models (LCCDE->IR, LCCDE->FR, IR->FR)  
• LCCDE solving via DTFT  
• Convolution of signals with infinite duration  
\* Digital frequency – DTFT spectrum of real signal is defined on real numbers ω ∈  
(– ∞, ∞), but it is periodic with period 2π and symmetric around ω=0. This  
means that the “interesting” frequency interval is only ω ∈ <0, π>.

Questions concerning topics from Lecture 4:  
• LTI system with linear phase (notation, properties)  
• System interconnection (series, parallel)  
• Signal-to-Noise-Ratio (definition, decibel

Questions concerning topics forom Lecture 5:  
• Sampling (relation of analog/digital frequency/spectrum, sampling  
(Nyquist) theorem, aliasing).  
• Sampling frequency change (decimation, interpolation, change by rational  
factor)  
• Discrete Fourier Transform – DFT (relation to DTFT, notation)

Questions concerning topics from Lecture 6:  
• Discrete Fourier Transform – DFT (linearity, symetry, periodicity,  
frequency resolution)  
• Circular convolution (meaning, computation of linear convolution using  
the circular one)  
• Linear convolution using overlap-add (motivation, basic implementation +  
utilization of FFT)  
• Fast Fourier Transform – FFT

Questions concerning Lecture 7:  
• Signals from the perspective of periodicity and their DFT spectrum  
• Short-time spectral analysis (motivation, principle, spectrogram)  
• Window (properties in time-domain, main parameters in frequency-  
domain)  
• Harmonic spectral analysis (definition, distinguishability of spectral  
components, effect of windowing)

Questions concerning Lecture 8:  
• Basic model of musical tone (basic parameters and their meaning)  
• Detection of the QRS complex in the ECG, algorithm and meaning of  
individual steps  
• Speech enhancement using spectral thresholding and spectral subtraction  
(assumptions about noise, meaning of individual steps)

Questions concerning lecture 9:  
• Z-transform (definition, relation to DTFT, linearity, convolutional  
theorem)  
• System (transfer) function of the LTI system (meaning, notation, zeros and  
poles)  
• Inverse Z-transform (polynomial division, partial fraction factorization)

Questions concerning Lecture 10:  
• LTI system analysis using Z-transform (stability, causality, realizable  
system)  
• Inverse system  
• System with minimum phase (definition, motivation)  
• Models of LTI system and their relations (LCCDE, frequency response,  
system function, impulse response)

Questions concerning Lecture 11:  
• Filter specifications (parameters)  
• Ideal frequency selective filter (why it cannot be used in practice)  
• Windowing method for design of FIR filters (principle, parameter choices)  
• Design of notch filters (principle, FIR/IIR variant and their properties)

Questions concerning Lecture 12:  
• FIR filter design using optimality criteria (least squares filters, equiriple  
filters – advantage over windowing metod)  
• Basic IIR filters types (magnitude response properties)  
• Comparison of IIR and FIR filters (stability, computational burden,  
latency, phase distortion)

Questions concerning lecture 13:  
• What is optimal filter?  
• How is it different to frequency selective filters?  
• Least squares optimal filter design (criterion, example)