# Examples of Quiz 2 questions

The exam covers material in Lectures 4 and 5.

* Describe the role of the **implementation reference model** in the design of DSP systems.

* The structure shown below is used to implement a symmetric fixed-point FIR filter, whose length is 11. The coefficients h_{0-6} are in s8.7 format, and the input signal is in s7.6 format. Find out what **s**-formats for the signal must be used at the points A, B, C, and D shown in the diagram below, that is, specify sufficient word length and fraction length for each point.
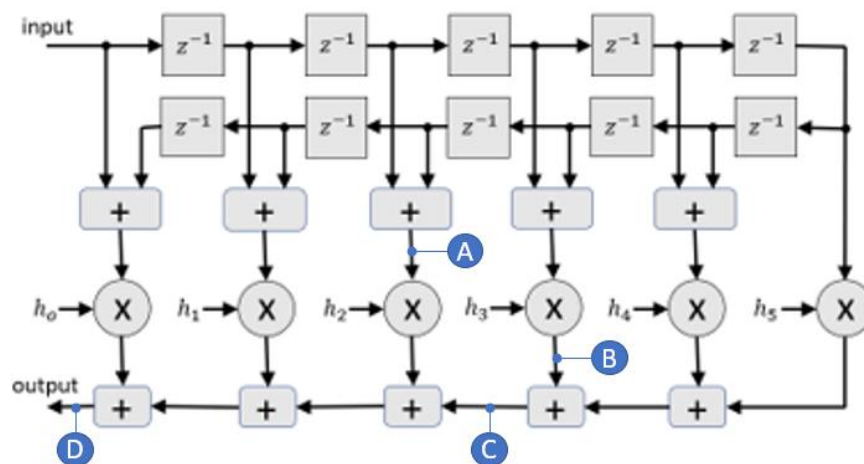
A: s__.__   B: s__.__   C: s__.__   D: s__.__

* Explain **operator overloading** in Matlab's fixed-point toolbox. What it does?

* The frequency response, pole-zero plot, and a direct form structure for an implementation of an IIR bandpass filter is shown below. Why a fixed-point implementation based on the direct form can be problematic? How second-order sections (SOS) are used to solve the problem?
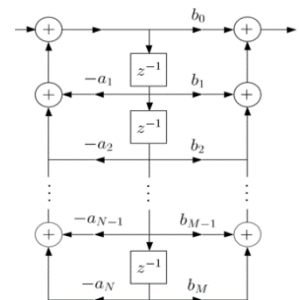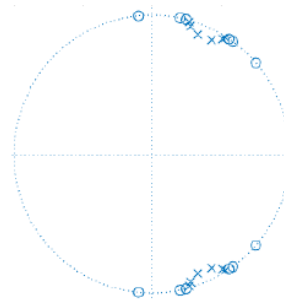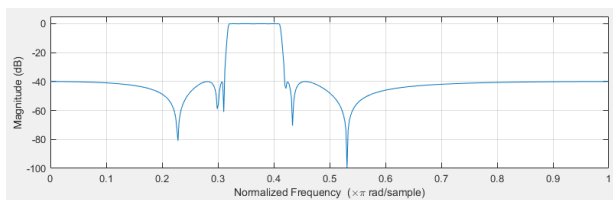
* What is the **crest factor** of an input signal? How is its value related to the design of a DSP system?

* What is the **input noise floor**? How should it be considered in the design of signal processing for a DSP system?
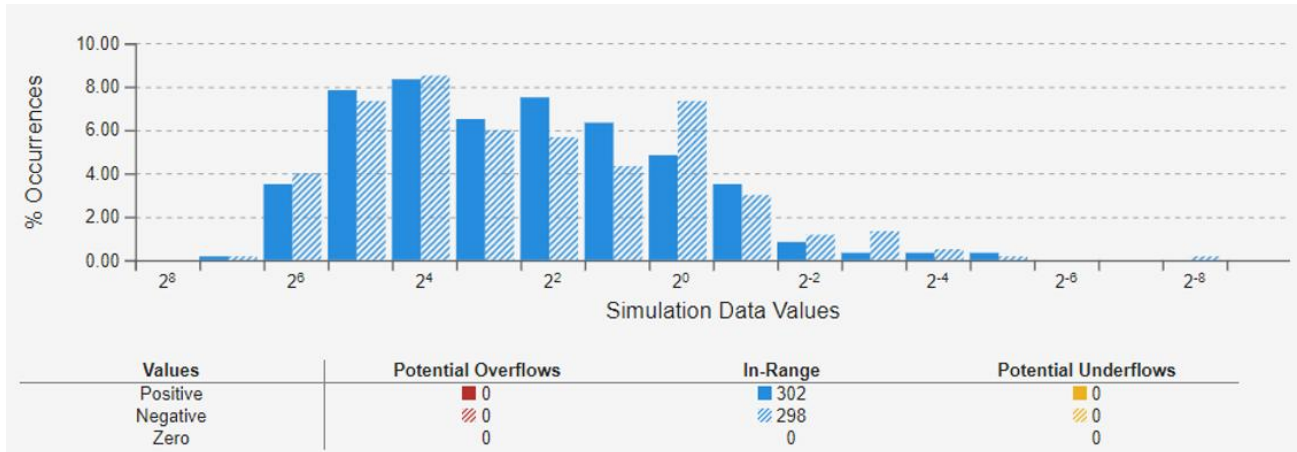
* Considering A/D conversion noise, what is the advantage of using higher sampling rate?

* What is the purpose of input signal **pre-scaling** in the fixed-point SOS IIR filter implementation?

* Data flow of a **second order IIR resonator** is shown on the left below. Alternative structure for implementing it, by proper choice of coefficients $\alpha, \beta, \gamma, \delta$, is shown on the right. What is the advantage of this alternative form?
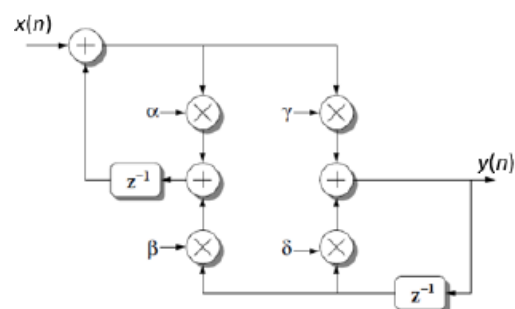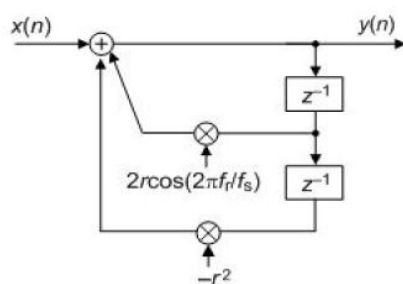
* You have performed simulation with double precision floating points in Matlab and when analyzing the magnitudes of some variable with **NumericTypeScope**, you observe the histogram below. Based on this observation, what binary point -scaled fixed-point format do you consider for the variable if you try to prevent all overflows and underflows?

Values	Potential Overflows	In-Range	Potential Underflows
Positive	■ 0	■ 302	■ 0
Negative	▨ 0	▨ 298	▨ 0
Zero	0	0	0

* In the diagram, the bars labeled 2^k corresponds to observed magnitudes $2^k \leq |x| < 2^{k+1}$.