Problems for exercise 1 (Architectures):

1. Problem 18.3 (this problem will be solved on the blackboard by the teacher)

2. Bluetooth is well suited for low-IF since just 20dB image rejection is sufficient. How many degrees of phase error $\Delta\phi$ does this correspond to if $\varepsilon=0$, and how many percent amplitude error does it correspond to if $\Delta\phi=0$?

   In mobile phones the so called near-far problem is severe. Suppose you want to build the receiver for a mobile phone using a low-IF architecture, and that the near-far problem makes the required IRR 80dB. How small errors in phase and amplitude would be required?

3. Uppgift 18.6 with extensions below (solved by teacher)

   If the 3:rd order non-linearities dominate for signal levels up to the compression point, calculate the relation between the 1dB compression point and 3:rd order intercept point.

4. Derive an expression for the phase difference between the outputs of an RC-CR link as a function of the frequency if the circuit is designed to generate quadrature signals. (solved by the teacher)

5. Design a phase shifting network that from **one** input signal creates two output signals with equal amplitudes and 90 degrees phase difference. All resistors should be 500Ω.

   Within which frequency band is the difference between the output amplitudes less than 5%?

   What is the input impedance when the outputs are unloaded?

   Does the phase difference and amplitude ratio change, in in that case by how much, when the outputs are loaded by 5kΩ each?

6. A single-stage polyphase filter is designed to generate signals in quadrature at the frequency ω_0. A differential signal is fed to two of the four input terminals, and the rest are grounded. If the absolute spread in capacitance is +-20%, how large can the output amplitude error be? (The relative capacitance spread is assumed to be equal to zero, and no spread at all is assumed for resistors)

7. If the matching between capacitors is +-0.2% in a single-stage polyphase filter, how large can the phase error become if all capacitors except one is assumed to have correct value? (The filter is connected as in previous problem)