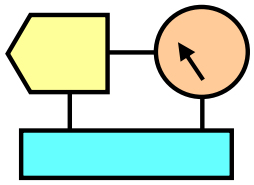
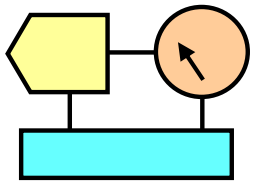


APPLIED ELECTONICS

Part D:

Class exercises 3

Analog-Digital and Digital-Analog conversion systems



Problem 1 – Assignment
A/D conversion

a) Plot the block diagram of a system for A/D conversion of signals from 4 channels. The input signals have dynamics $[1\ \mathrm{V} - 2\ \mathrm{V}]$ and bandwidth $0 - 15\ \mathrm{kHz}$. The system must use one A/D converter (dynamics $[0 - 5\ \mathrm{V}]$ and $\mathrm{T_c} = 500\ \mathrm{ns}$) and one S/H with acquisition time $\mathrm{T_{acq}} = 700\ \mathrm{ns}$.

b) Determine the maximum and minimum sampling frequency.

c) Draw the circuit of the conditioning amplifier (if it is necessary) and calculate the value of the resistors of the circuit.

d) If the input signals are sine waves with dynamics $[1\ \mathrm{V} - 2\ \mathrm{V}]$, calculate the minimum number of bit to guarantee $\mathrm{SNR_q} > 35\ \mathrm{dB}$.

e) If the input sine wave has amplitude $\mathrm{V_P}$ variable in the range between $0.5\ \mathrm{V}$ and $2.5\ \mathrm{V}$ (i.e: $\mathrm{V_{Pmin}} = 0.5\ \mathrm{V}$ and $\mathrm{V_{Pmax}} = 2.5\ \mathrm{V}$) and average value equal to $1.5\ \mathrm{V}$, calculate the minimum number of bits of the A/D to guarantee $\mathrm{SNR_q} > 35\ \mathrm{dB}$.

Problem 2 – Assignment
D/A conversion
(NOTE: circuit of LAB 3)

Given the circuit shown in the figure where the CD4029 is a counter with $V_{CC} = 5\ V$ and OA is an operational amplifier with $V_{CC} = \pm 10\ V$, calculate the resistors to satisfy the following conditions:

a) Full scale output voltage $V_{fs} = -5V$

b) Error in the MSB output voltage due to the "equivalent resistance of the switches" less than ½ LSB.