Half-semester exam ISS, 23.10.2008, English, group A

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Exercise 1 The signal is the CZK/EUR exchange rate at the end of every working day.

The signal is:

A	B	C	D
deterministic discrete time	random discrete time	deterministic continuous time	random continuous time

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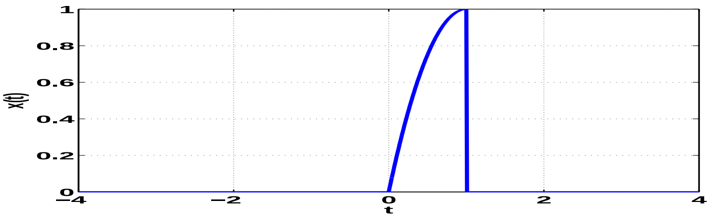
Exercise 2 Signal $x(t)$ is defined as

$$x(t) = \begin{cases} 1-t^2 & \text{for } t \in [0,\ 1] \\ 0 & \text{otherwise} \end{cases}$$

The figure:



shows signal:

A	B	C	D
$x(-t-1)$	$x(-t+1)$	$-x(-t-1)$	$-x(-t+1)$

Exercise 3 The phase of harmonic signal, defined using a delay: $x(t) = 45\cos[\frac{1}{16}\pi(t-0.4)]$ is

A	B	C	D
ϕ_1 =-0.0393 rad	ϕ_1 =-0.0785 rad	ϕ_1 =-0.0982 rad	ϕ_1 =-0.1178 rad

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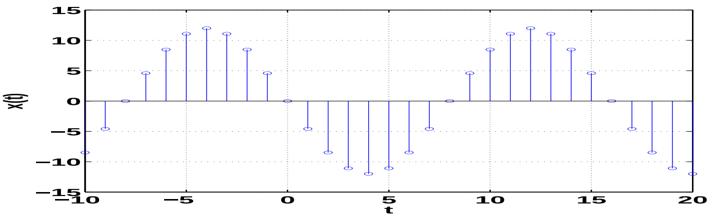
Exercise 4

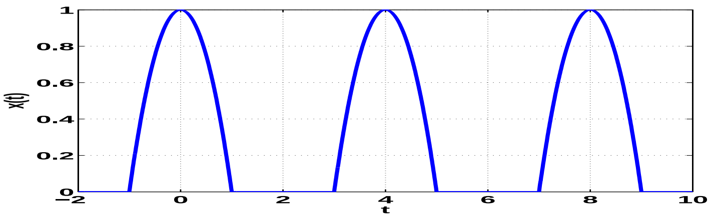


The figure shows discrete cosine $x[n] =$

A	B	C	D
$12\cos(0.7854n+\frac{\pi}{2})$	$12\cos(0.3927n+\frac{\pi}{2})$	$12\cos(0.7854n-\frac{\pi}{2})$	$12\cos(0.3927n-\frac{\pi}{2})$

Exercise 5 Periodic continuous time signal is defined as a series of parabolas interleaved by intervals of zeros (attention, it is not a rectified cosine !):

$$x(t) = \begin{cases} 1 - t^2 & \text{for } t \in [-1,\ 1] \\ 0 & \text{for } t \in [-2,\ -1] \text{ a } t \in [1,\ 2] \end{cases} \qquad \text{with period } T_1 = 4$$



The average value of the signal is

A	B	C	D
$\bar{x} = 0.3333$	$\bar{x} = 0.2725$	$\bar{x} = 0.5$	$\bar{x} = 0.5644$

Exercise 6 The average power of the signal from Exercise 5 is

A	B	C	D
$P_s = 0.1855$	$P_s = 0.2$	$P_s = 0.2667$	$P_s = 0.3816$

Exercise 7 Signal $x_1(t)$ is non-zero in interval $t \in [0,\ 2]$ and signal $x_2(t)$ is non-zero in interval $t \in [0,\ 3]$.

Dteremine, in which interval their convolution $y(t) = x_1(t) \star x_2(t)$ will be non-zero:

A	B	C	D
$t \in [-\infty, +\infty]$	$t \in [0,\ 3]$	$t \in [0,\ 5]$	$t \in [0,\ 6]$

Exercise 8 For $n = [0\ \ 1\ \ 2\ \ 3\ \ 4]$, the folowing discrete signals are given:
$x_1[n] = [5\ \ 3\ \ 0\ \ 0\ \ 0]$ and $x_2[n] = [-1\ \ 1\ \ 0\ \ 0\ \ 0]$
The result of their convolution $y[n] = x_1[n] \star x_2[n]$, for $n = [0\ \ 1\ \ 2\ \ 3\ \ 4\ \ 5]$, is signal $y[n] =$

[-5 3 2 0 0]	[5 -3 -2 0 0]	[-5 2 3 0 0]	[5 -2 -3 0 0]

Exercise 9 A discrete system has an impulse reponse $h[n]$, that is non-zero only for $n \leq 0$
The system is:

A	B	C	D
causal	non-causal	on the boundary of causality	can not determine

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Exercise 10 The periodic signal from Exercise 5 will have the following coefficients of Fourier series:

A	B	C	D
positive c_0 non-zero only c_1, c_{-1} zero c_k for $\lvert k \rvert > 1$	zero c_0 non-zero c_k for $k \in [1, +\infty)$ and $k \in (-\infty, -1]$	positive c_0 non-zero only c_1, c_{-1} zero c_k for $\lvert k \rvert > 1$	zero c_0 non-zero c_k for $k \in [1, +\infty)$ and $k \in (-\infty, -1]$