Home work 4 : Due date after one week (
Course: Digital Communication for MIT
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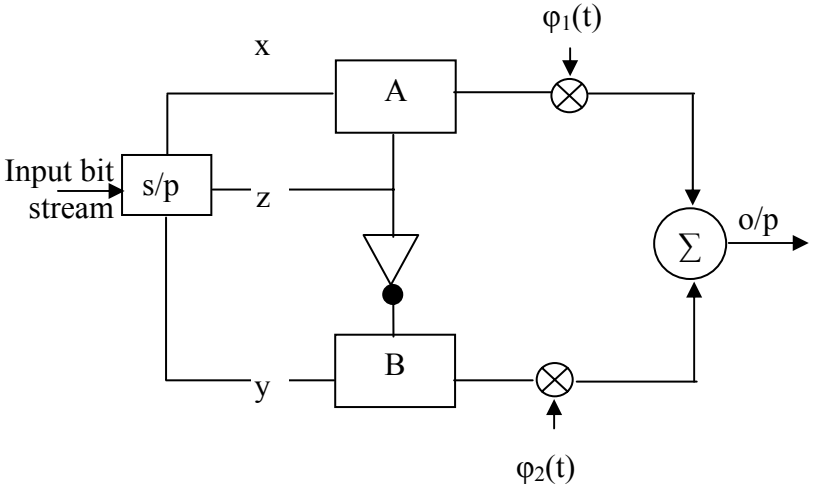
Q1. In the shown transmitter the amplifiers A& B are controlled by a control bit "z". If "z" is '1' the amplification ratio (for A and B) is 2:1 and if "z" is '-1' the ratio (for A and B)is 1:1. The input stream is divided into symbols each of 3 bits designated as xyz in order. The bits are represented using polar NRZ format with =5v and –A=-5v.

1. Find all possible outputs of the transmitter in terms of ϕ1 and ϕ2.
2. Sketch to scale the signals in Signal space. and define the Decision Regions (DR) and the Decision Boundaries(DB).



Q2. A communication system uses a signal $s_1(t) = 3\cos(200\pi t) \quad 0 \le t \le 2\text{sec}$ to represent the digit '1'.
To present the digit '0' either $s_2(t)$ or $s_2'(t)$ is available, where
$s_2(t) = -4\cos(200\pi t)$ $s_2'(t) = 4\cos(400\pi t) \quad 0 \le t \le 2\text{sec}$.
The noise is assumed to be AWGN with two-sided PSD= $\frac{N_0}{2}$ =2watt/Hz.

1. Sketch to scale the two cases in S.S. showing the DRs and the DBs.
2. Calculate the minimum average probability of error.
3. Show that the receiver in both cases can be implemented using a single arm receiver and define each part of the receiver.

Q3. The below digital modulator scheme produces 4 equally likely messages.

1. Sketch the output possible signals in SS.
2. Draw the DRs and DBs.
3. Calculate the average energy.
4. Calculate the minimum average probability of error if the noise is assumed to be AWGN of zero mean and PSD= $\frac{N_0}{2}$