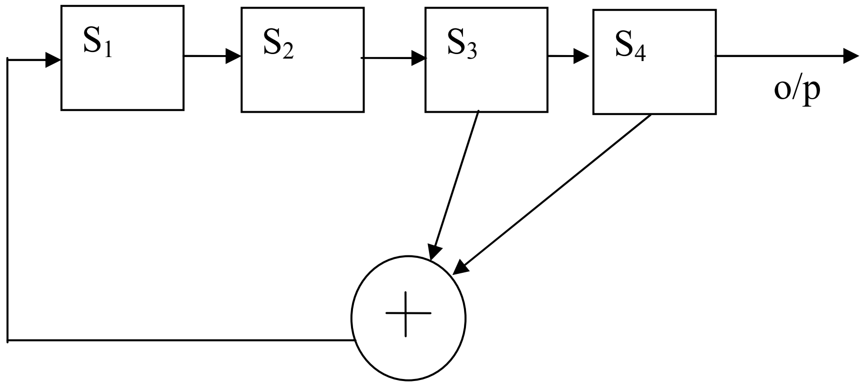
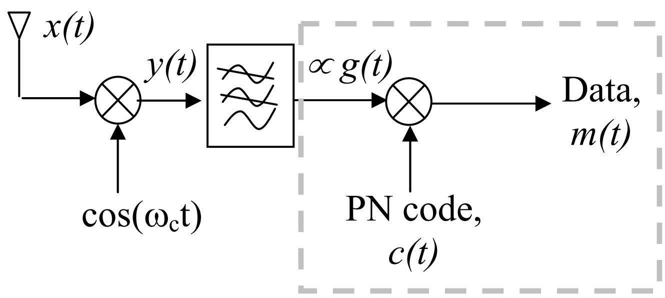
EEE 317 Tutorial questions – PN sequences and S.S. systems

1) We're dealing with binary here, so p=2, and 4 shift registers, so n = 4. The PN code generator looks like this.



2) Barker codes are especially designed PN sequences to give excellent autocorrelation properties. This property makes them especially useful for synchronisation applications.

3)



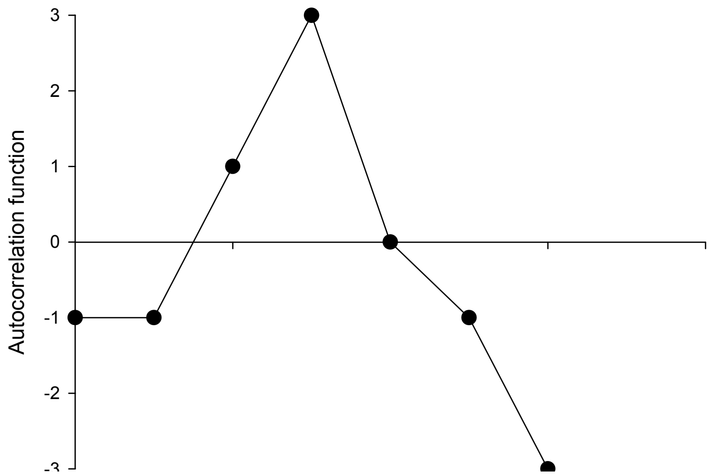
4) DSSS; $G = T_b/T_{CH}$
FHSS; $G = f_h T_b$ where symbols have their usual meanings

5) A FHSS system is defined as 'fast hopping' if the hop frequency, f_h is greater than the inverse symbol period, $1/T_b$.

6) The quality of a square wave waveform, i.e. the abruptness of the transition between high and low and vice versa, is roughly proportional to the bandwidth. Hence SS systems, which occupy a large bandwidth by definition, give high quality square waves and hence accurate timing signals.

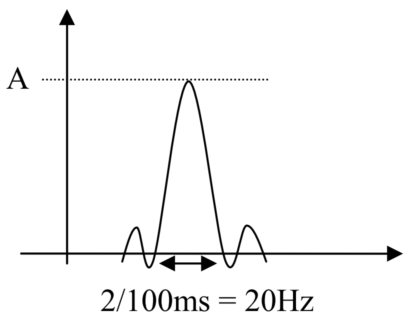
7)

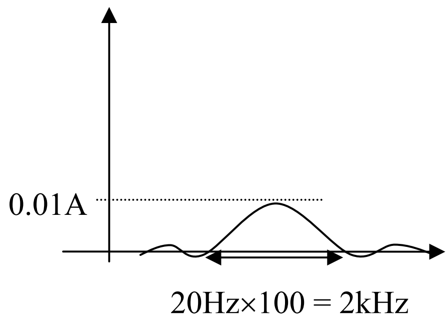
x	x	x	1	1	0	Autocorrelation
1	1	0	0	0	0	-1
0	1	1	0	0	0	-1
0	0	1	1	0	0	+1
0	0	0	1	1	0	+3
0	0	0	0	1	1	-1
0	0	0	0	0	1	-3



The code is not good for synchronisation applications because of the poor autocorrelation.

8) Before spreading… After spreading….





9) The spectrum of a PN code is discrete as it repeats, whereas a true noise sequence (which does not repeat) is continuous.

10) The resulting PN code 110 has two 1's and one zero so it meets the balance and run requirements. Autocorrelation is not good because of the -3 side lobe but if we wrap the code around itself we eliminate that and it becomes a good PN code. Actually this is a Barker code with 3 bits length.