

EE 4140: Digital Communication Systems

August 22, 2022

Tutorial #2

KG/IITM

1. Find the compact ortho-normal basis set, and using it, make a clear labeled plot of the signal constellation for the signal set shown in Fig-1.

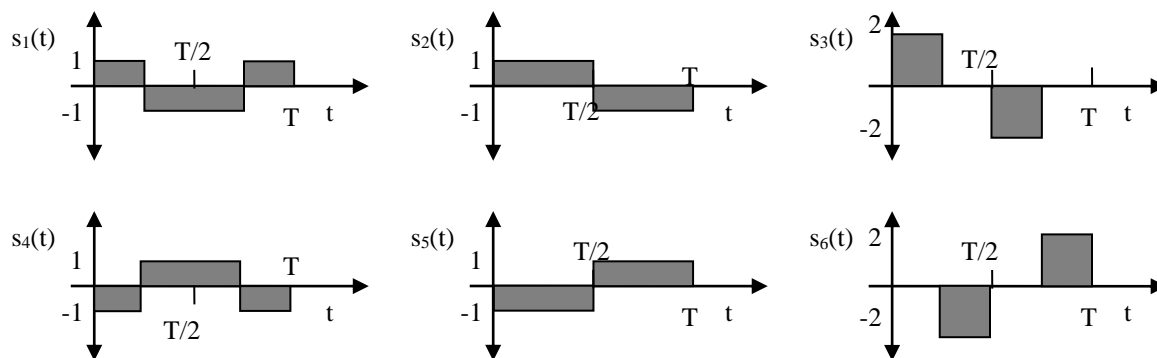


Fig-1

2. The signal $g(t)$ is sent through a channel with impulse response $h(t)$, where the two functions are shown in Fig-2. Make a labeled plot of the ideal matched filter's impulse response. *Hint:* Assume single-shot communication.

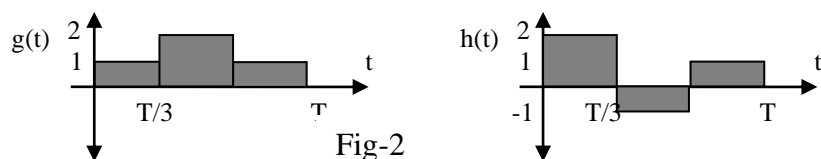


Fig-2

3. Find the autocorrelation function $S(t)$ for the given signal $g(t)$ in Fig3. Draw the signal $S(t)$.

where

$$S(t) = \int_{-\infty}^{\infty} g(\tau)g(t - \tau)d\tau$$

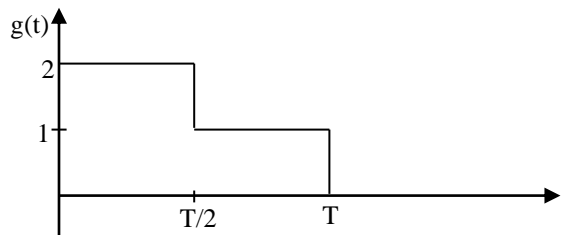


Fig-3

4. Find out the compact basis function for signals given in Fig-4.

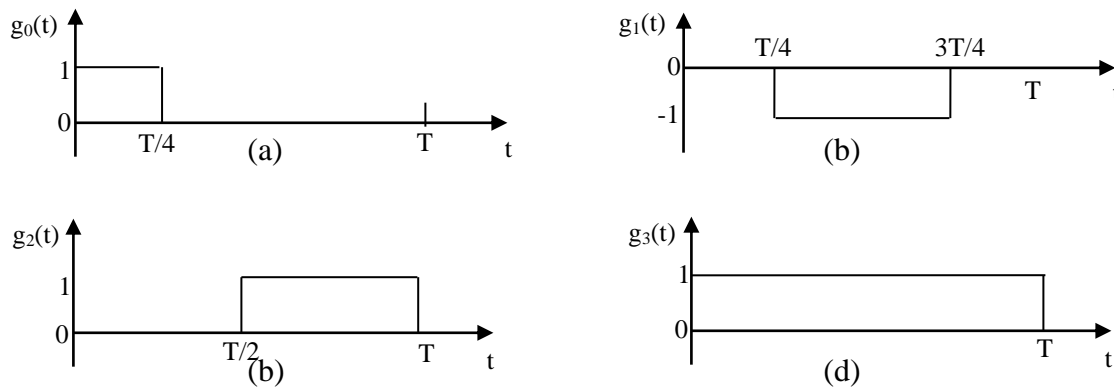


Fig-4

5. Consider the signal set shown in Fig-5 below.

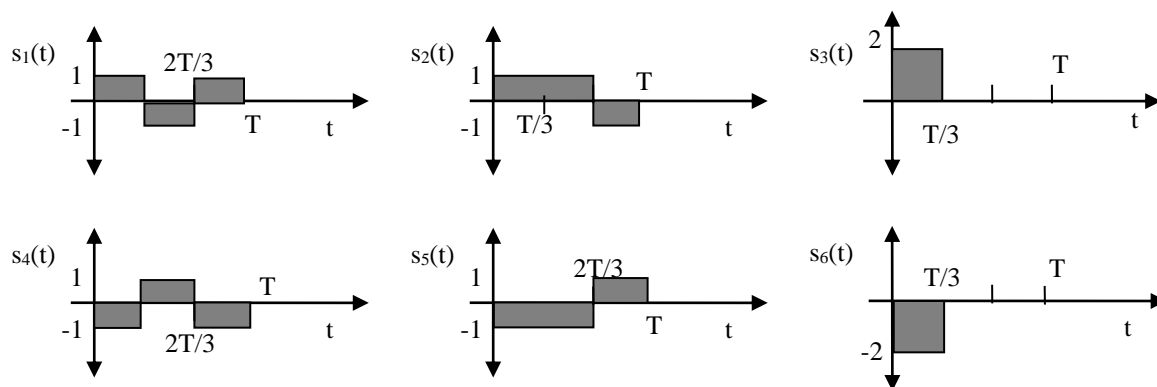


Fig-5

(a) Find a compact orthonormal basis set for this signal set. Sketch these functions.

(b) Using this, make a clear labeled plot of the corresponding signal constellation.

(c) In terms of the average energy E_a of the constellation, what is the minimum distance (i.e., $2d$) of the signal set?

6. Find the minimum distance and multiplicity for given signals in Fig-6.

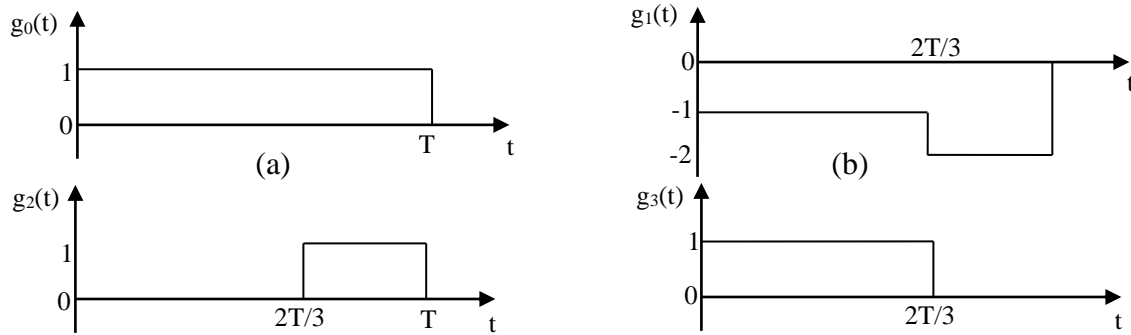


Fig-6

7. Do the following problems from the 7th chapter in the text-book (Proakis and Salehi), starting with page. 453 in the E-version.
 → All problems from [7.1 to 7.9](#). The possibly hard-one is perhaps are 7.8*.