ECS 452: In-Class Exercise # 19

Instructions

1. Separate into groups of no more than three persons. **The group cannot be the same as any of your former groups after the midterm.**
2. **Write down all the steps** that you have done to obtain your answers. You may not get full credit even when your answer is correct without showing how you get your answer.
3. **Do not panic.**

Date: 11 / 05 / 2018			
Name	ID (last 3 digits)		
Prapun	**5**	**5**	**5**

A digital communication system transmits a stream of bits by mapping each block of three bits to one of the possible waveforms $s_1(t), s_2(t), \ldots, s_M(t)$. The waveform is then transmitted via a communication channel which corrupts the waveform by independently adding a white noise process $N(t)$ whose power spectral density is given by $S_N(f) \equiv 16$ across all frequency. $\frac{N_0}{2}$

a. What is the value of M?

Three bits ⇒ 8 possibilities for the block

⇒ need 8 different waveforms to represent 8 distinct block patterns

b. Suppose we apply GSOP to the M waveforms and get two orthonormal axes $\phi_1(t)$ and $\phi_2(t)$. Let $N_j = \langle N(t), \phi_j(t) \rangle$. Find

See 7.26f

i. $\mathbb{E}[N_1] = 0$

ii. $\mathrm{Var}[N_1] = \frac{N_0}{2} = 16$

iii. $\sigma_{N_1} = \sqrt{\mathrm{Var}[N_1]} = \sqrt{16} = 4$

iv. $\mathbb{E}[N_1 N_2] = 0$