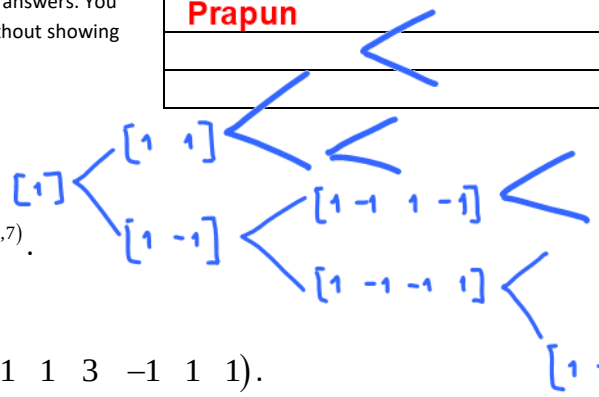
ECS 455: In-Class Exercise # 16

Instructions

1. Separate into groups of no more than three persons.
2. The group cannot be the same as any of your former groups in this class.
3. Only one submission is needed for each group.
4. ***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.
5. **Do not panic.**

Date: 1 7 / 0 5 / 2017			
Name	ID (last 3 digits)		
Prapun	5	5	5



Consider a system which uses OVFS codes.

User 1 uses code $\underline{c}^{(4,2)}$. User 2 uses code $\underline{c}^{(8,7)}$.

The codes for other users are unknown.

Suppose the received vector is $\underline{r} = (-3 \quad 1 \quad 1 \quad 1 \quad 3 \quad -1 \quad 1 \quad 1)$.

(a) $\underline{c}^{(4,2)}$ = **[1 -1 1 -1]**

(b) $\underline{c}^{(8,7)}$ = **[1 -1 -1 1 -1 1 1 -1]**

Note that OVSF codes use only ±1.

Therefore, $\langle \underline{c}^{(N,j)}, \underline{c}^{(N,j)} \rangle = N$. ← the length of the code

(c) Recover the message(s) for user 1. User 1 uses code $\underline{c}^{(4,2)}$.

The length of $\underline{c}^{(4,2)}$ is 4.

The length of $\underline{r}$ is 8. Therefore, it contains $\frac{8}{4} = 2$ message symbols for user 1.

$\hat{a}_1 = \frac{1}{4} \langle \underline{r}(1:4), \underline{c}^{(4,2)} \rangle = \frac{1}{4} (-3 - 1 - 1 + 1) = -1.$ ($(-3,1,1,1)$, $(1,-1,1,-1)$)

$\hat{a}_2 = \frac{1}{4} \langle \underline{r}(5:8), \underline{c}^{(4,2)} \rangle = \frac{1}{4} (3 + 1 + 1 - 1) = 1.$ ($(3,-1,1,1)$, $(1,-1,1,-1)$)

$\Rightarrow$ The message symbols for user 1 are (−1, 1).

$\langle \underline{c}^{(4,2)}, \underline{c}^{(4,2)} \rangle$

(d) Recover the message(s) for user 2. User 2 uses code $\underline{c}^{(8,7)}$.

The length of $\underline{c}^{(8,7)}$ is 8.

The length of $\underline{r}$ is 8. Therefore, it contains $\frac{8}{8} = 1$ message symbol for user 2.

$\hat{b}_1 = \frac{1}{8} \langle \underline{r}(1:8), \underline{c}^{(8,7)} \rangle = \frac{1}{8} (-3 - 1 - 1 + 1 - 3 - 1 + 1 - 1) = -1.$

$\Rightarrow$ The message symbol for user 2 is −1.

Remark: $\underline{x}^{(1)} = [\, a_1 \underline{c}^{(4,2)} \quad a_2 \underline{c}^{(4,2)} \,] = [-1 \quad 1 \quad -1 \quad 1 \quad 1 \quad -1 \quad 1 \quad -1]$

$\underline{x}^{(2)} = [\, b_1 \underline{c}^{(8,7)} \,] = [-1 \quad 1 \quad 1 \quad -1 \quad 1 \quad -1 \quad -1 \quad 1]$

$\underline{x}^{(1)} + \underline{x}^{(2)} = [-2 \quad 2 \quad 0 \quad 0 \quad 2 \quad -2 \quad 0 \quad 0] \neq \underline{r}$

Because we assume that there is no noise nor fading in our CDMA analysis, there must be message(s) for at least one more user.