%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% Homework 1

% 9/23/2011

% AAE57500

% Josh Wildey

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clear all

clc

% Problem 1

% Choose PRN 22 & 27

sv = [22 27];

% Generate C/A Code

ca = cacodegen(sv);

% Problem 2

% Get BPSK of C/A Code

bpsk = BPSK(ca);

% Auto correlation of PRN 22 for -10 chips <= t <= 10 chips

prn22\_corr = corr(bpsk(1,:));

figure(1)

plot(-10:1:10,prn22\_corr);

title('Autocorrelation of PRN 22'),xlabel('\tau'),ylabel('R\_2\_2')

prn22\_p1 = max(prn22\_corr(1:5));

prn22\_p2 = min(prn22\_corr(5:10));

prn22\_p3 = max(prn22\_corr(9:11));

% Auto correlation of PRN 27 for -10 chips <= t <= 10 chips

prn27\_corr = corr(bpsk(2,:));

figure(2)

plot(-10:1:10,prn27\_corr);

title('Autocorrelation of PRN 27'),xlabel('\tau'),ylabel('R\_2\_7')

prn27\_p1 = min(prn27\_corr(6:8));

prn27\_p2 = max(prn27\_corr(8:12));

% Cross correlation between PRN 22 & PRN 27 for -10 chips <= t <= 10 chips

prn2227\_corr = corr(bpsk(1,:),bpsk(2,:));

figure(3)

plot(-10:1:14,prn2227\_corr);

title('Cross Correlation between PRN 22 & PRN 27'),xlabel('\tau'),ylabel('R\_2\_2\_-\_2\_7')

prn2227\_p1 = max(prn2227\_corr(1:10));

prn2227\_p2 = max(prn2227\_corr(10:19));

prn2227\_p2 = min(prn2227\_corr);

function ca = cacodegen(sv)

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% This function will accept a SV ID and generate a 1023 chip C/A code for

% the specified satellite.

%

% Ex) For PRN 22 and 27:

% g = cacodegen([22 27])

%

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%Store G2i or value

ph\_sel = [2 6;

3 7;

4 8;

5 9;

1 0;

2 10;

1 8;

2 9;

3 10;

2 3;

3 4;

5 6;

6 7;

7 8;

8 9;

9 10;

1 4;

2 5;

3 6;

4 7;

5 8;

6 9;

1 3;

4 6;

5 7;

6 8;

7 9;

8 10;

1 6;

2 7;

3 8;

4 9;

5 10;

4 10;

1 7;

2 8;

4 10];

% Initialize g1 and g2

% G1 LFSR: 1+ x^3 + x^10

s = [0 0 1 0 0 0 0 0 0 1];

n = length(s);

g1 = ones(1,n);

%G2 LFSR: 1 + x^2 + x^3 + x^6 + x^8 + x^9 + x^10

t = [0 1 1 0 0 1 0 1 1 1];

g2 = ones(1,n);

%Define variables for homework

chips = 2^n - 1;

ca = zeros(2,chips);

%Generate 1023 Chip long C/A Code

for cnt = 1:chips

%G1 is the 10th bit

g1out = g1(n);

%G2 is the XOR of 2 chips chosen by the PRN/sv

g2out = xor(g2(ph\_sel(sv,1)),g2(ph\_sel(sv,2)));

%C/A Code is the XOR of g1out and g2out

ca(:,cnt) = xor(g1out,g2out);

%Shift G1 left by 1 and XOR chips 3 and 10

g1 = [mod(sum(g1.\*s),2) g1(1:9)];

%Shift G2 left by 1 and XOR chips 2,3,6,8,9,10

g2 = [mod(sum(g2.\*t),2) g2(1:9)];

end

function bpsk = BPSK(cacode)

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% This function will convert a binary C/A code to its BPSK

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bpsk = zeros(size(cacode));

for i = 1:length(cacode)

%For First row

if cacode(1,i) == 0

bpsk(1,i) = 1;

else

bpsk(1,i) = -1;

end

%For Second row

if cacode(2,i) == 0

bpsk(2,i) = 1;

else

bpsk(2,i) = -1;

end

end

function R = corr(bpsk,bpsk2)

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% This function will autocorrelate a BPSK for -10 <= t <= 10 chips

% with the option of cross correlating two BPSKs.

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% Check if we're doing Auto Correlation or Cross Correlation

% Auto Correlation

R = zeros(1,length(1:1:21));

if exist('bpsk2','var') == 0

% Auto Correlation Computation

for t = -10:10

if t < 0

bpsk\_delay = [bpsk(abs(t)+1:length(bpsk)) bpsk(1:abs(t))];

else

bpsk\_delay = [bpsk(length(bpsk)-t+1:length(bpsk)) bpsk(1:length(bpsk)-t)];

end

R(t+11) = 1/length(bpsk)\*sum(bpsk.\*bpsk\_delay);

end

% Cross Correlation

else

for t = -10:14

if t<0

bpsk\_delay = [bpsk2(abs(t)+1:length(bpsk2)) bpsk2(1:abs(t))];

else

bpsk\_delay = [bpsk2(length(bpsk2)-t+1:length(bpsk2)) bpsk2(1:length(bpsk2)-t)];

end

R(t+11) = 1/length(bpsk)\*sum(bpsk.\*bpsk\_delay);

end

end

