Question 1

clear all;

nonlin\_meas\_data

row = zeros(1,m);

row(1) = -1;

row(2) = 1;

col = zeros(1,m-1);

col(1) = -1;

B = toeplitz(col,row);

cvx\_begin

variable x(n);

variable z(m);

minimize(norm(z-A\*x));

subject to

1/beta\*B\*y <= B\*z;

B\*z <= 1/alpha\*B\*y;

cvx\_end

disp('estimated x:'); disp(x);

plot(z,y)

ylabel('y')

xlabel('z')

title('ML estimate of \phi')

A screenshot of a cell phone

Description generated with very high confidence

Question 2

clear all;

ml\_estim\_incr\_signal\_data

% maximum likelihood estimation with no monotonicity taken into account

cvx\_begin

variable xls(N)

yhat = conv(h,xls);

minimize (sum\_square(yhat(1:end-3) - y))

cvx\_end

% monotonic and non negative signal estimation

cvx\_begin

variable xmono(N)

yhat = conv(h,xmono);

minimize (sum\_square(yhat(1:end-3) - y))

subject to

xmono(1) >= 0;

xmono(1:N-1) <= xmono(2:N);

cvx\_end

t = 1:N;

figure;

set(gca, 'FontSize', 12);

plot(t, xtrue, 'r', t, xmono, '--', t, xls, 'k:');

xlabel('t');

legend('xt', 'xmono', 'xls', 'Location', 'SouthEast');

A close up of a map

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Question 3

clear all;

sep3way\_data

cvx\_begin

variables a1(2) a2(2) a3(2) b1 b2 b3

(a1 - a2)'\*X - (b1 - b2) >= 1

(a1 - a3)'\*X - (b1 - b3) >= 1

(a2 - a1)'\*Y - (b2 - b1) >= 1

(a2 - a3)'\*Y - (b2 - b3) >= 1

(a3 - a1)'\*Z - (b3 - b1) >= 1

(a3 - a2)'\*Z - (b3 - b2) >= 1

a1 + a2 + a3 == 0

b1 + b2 + b3 == 0

cvx\_end

% maximally confusing point

p = [(a1-a2)';(a1-a3)']\[(b1-b2);(b1-b3)];

% plot

plot(X(1,:),X(2,:),'\*');

hold on;

plot(Y(1,:),Y(2,:),'ro');

plot(Z(1,:),Z(2,:),'g+');

plot(p(1),p(2),'ks');

t = [-5:0.01:8];

u1 = a1 - a2; v1 = b1 - b2;

u2 = a2 - a3; v2 = b2 - b3;

u3 = a3 - a1; v3 = b3 - b1;

line1 = (-t\*u1(1) + v1)/u1(2);

idx1 = find(u2'\*[t;line1] - v2 > 0);

plot(t(idx1),line1(idx1));

line2 = (-t\*u2(1) + v2)/u2(2);

idx2 = find(u3'\*[t; line2] - v3 > 0);

plot(t(idx2),line2(idx2),'r');

line3 = (-t\*u3(1) + v3)/u3(2);

idx3 = find(u1'\*[t; line3] - v1 > 0);

plot(t(idx3),line3(idx3),'g');

A close up of a map

Description generated with high confidence