a) Solve with L-1 norm

```
A = [1,1; 0,1];
b = [0.5; 1];

f = [zeros(10,1);ones(10,1)];

Aeq = [A^9*b, A^8*b, A^7*b, A^6*b, A^5*b, A^4*b, A^3*b, A^2*b, A^1*b, A^0*b, zeros(2,1
beq = [1;0];


Als = [eye(10), -eye(10); -eye(10), -eye(10)];
bls = zeros(20,1);

X = linprog(f, Als, bls, Aeq, beq)
```

```
Optimal solution found.
X = 20×1
    0.1111
         0
         0
         0
         0
         0
         0
         0
         0
   -0.1111
    ⋮
```

```
p = X(1:10);
t = linspace(1,10,10);

figure
plot(t,p)
title('Plot of p(t) vs t');
xlabel('Time (s)');
ylabel('Force (N)');
```

```
t = linspace(0, 10, 11);
x = zeros(11,2);
for i = 2:11
    x(i,:) = (A*x(i-1,:)'+b*p(i-1))';
end

figure
plot(t, x(:,1));
title('Plot of x(t) vs t');
xlabel('Time (s)');
ylabel('x(t)');
```

```
figure
plot(t, x(:,2));
title('Plot of x_{dot}(t) vs t');
xlabel('Time (s)');
```

```
ylabel('x_{dot}(t)');
```

Solution with L1 norm is very sparse.

b) Solve with L-inf norm

```
A = [1,1; 0,1];
b = [0.5; 1];

f = [zeros(10,1);1];

Aeq = [A^9*b, A^8*b, A^7*b, A^6*b, A^5*b, A^4*b, A^3*b, A^2*b, A^1*b, A^0*b, zeros(2,1
beq = [1;0];


Als = [-eye(10), -ones(10,1); eye(10), -ones(10,1)];
bls = zeros(20,1);

X = linprog(f, Als, bls, Aeq, beq)
```

```
Optimal solution found.
X = 11×1
    0.0400
    0.0400
    0.0400
    0.0400
    0.0400
   -0.0400
   -0.0400
   -0.0400
   -0.0400
   -0.0400
     ⋮
```

```
p = X(1:10);
```

```
t = linspace(1,10,10);

figure
plot(t,p)
title('Plot of p(t) vs t');
xlabel('Time (s)');
ylabel('Force (N)');
```

```
t = linspace(0, 10, 11);
x = zeros(11,2);
for i = 2:11
    x(i,:) = (A*x(i-1,:)'+b*p(i-1))';
end

figure
plot(t, x(:,1));
title('Plot of x(t) vs t');
xlabel('Time (s)');
ylabel('x(t)');
```

```
figure
plot(t, x(:,2));
title('Plot of x_{dot}(t) vs t');
xlabel('Time (s)');
ylabel('x_{dot}(t)');
```

Magnitude of force is evenly distributed across all timesteps which minimizes the maximum. Makes sense for L-inf norm.