

```
m = 5;
b = 2;

dt = 0.2;

Tfinal = 10;
data_length = Tfinal / dt;
```

```
A = [-b/m 0; 1 0]
```

```
A = 2x2
    -0.4000    0
    1.0000    0
```

```
B = [1/m; 0]
```

```
B = 2x1
    0.2000
    0
```

```
H = [0 1]
```

```
H = 1x2
    0    1
```

```
R = 3
```

```
R = 3
```

```
Q = diag([0.001 0.0001])
```

```
Q = 2x2
10-3 x
    1.0000    0
    0    0.1000
```

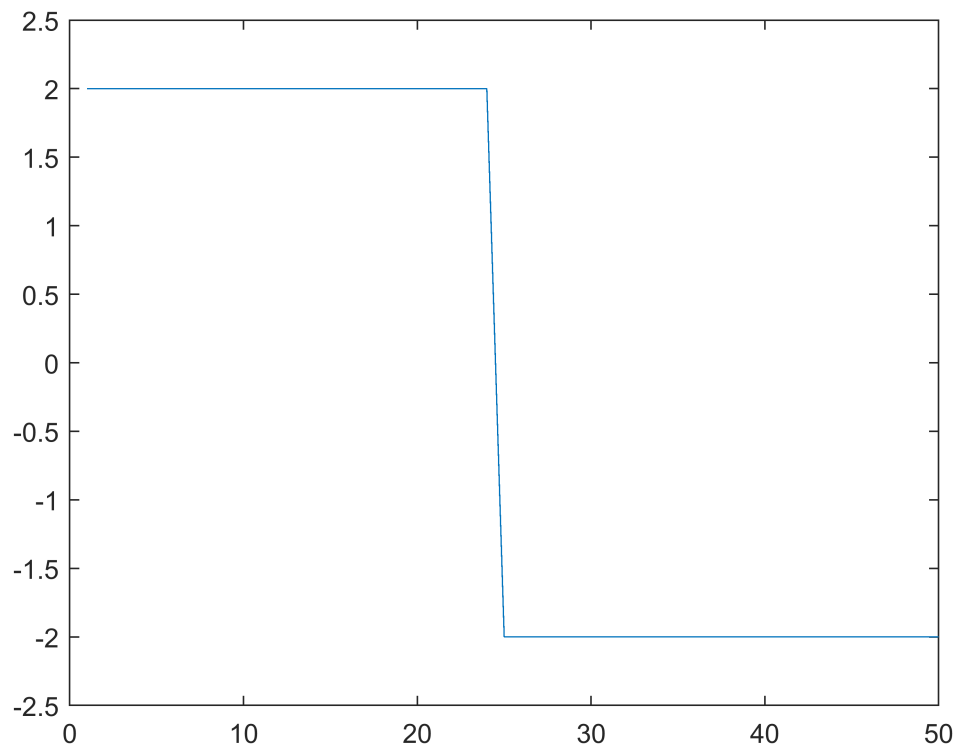
```
Ad = eye(size(A)) + dt * A
```

```
Ad = 2x2
    0.9200    0
    0.2000    1.0000
```

```
Bd = dt * B
```

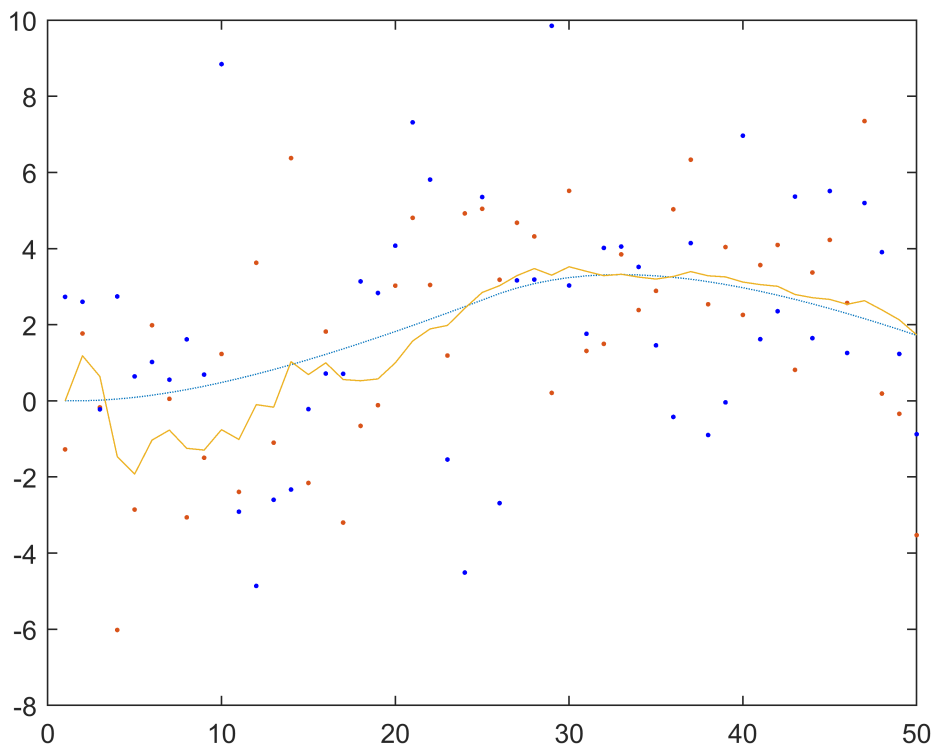
```
Bd = 2x1
    0.0400
    0
```

```
u = zeros(1, data_length);
u(1:data_length/2) = 2;
u(data_length/2:end) = -2;
plot(u)
ylim([-2.5 2.5])
```



```
X = zeros(2, data_length);  
  
for i = 1:data_length-1  
    w = diag(Q) .* randn(2, 1);  
    X(:,i+1) = Ad * X(:,i) + Bd * u(i) + w;  
end
```

```
v = R * randn(size(u));  
Z = H * X + v;  
plot(Z, 'b.')
```



```

X_pred = zeros(size(X));
X_update = zeros(size(X));

P = diag([2, 6]);

X_update(:,1) = [0; 1];

for i = 2:data_length
    X_pred(:, i) = Ad * X_update(:,i-1) + Bd * u(i);
    P = Ad * P * Ad' + Q;
    y = Z(i) - H * X_pred(:,i);
    S = H * P * H' + R;
    K = P' * H' * inv(S);
    X_update(:,i) = X_pred(:,i) + K * y;
    P = (eye(size(A)) - K * H) * P;
end

```

```

figure
hold on
plot(Z, '.')
plot(X_update(2,:))
plot(X(2,:), ':')
legend("Measurements", "Estimate", "True Position")

```

