

CSCI 545: Homework 3

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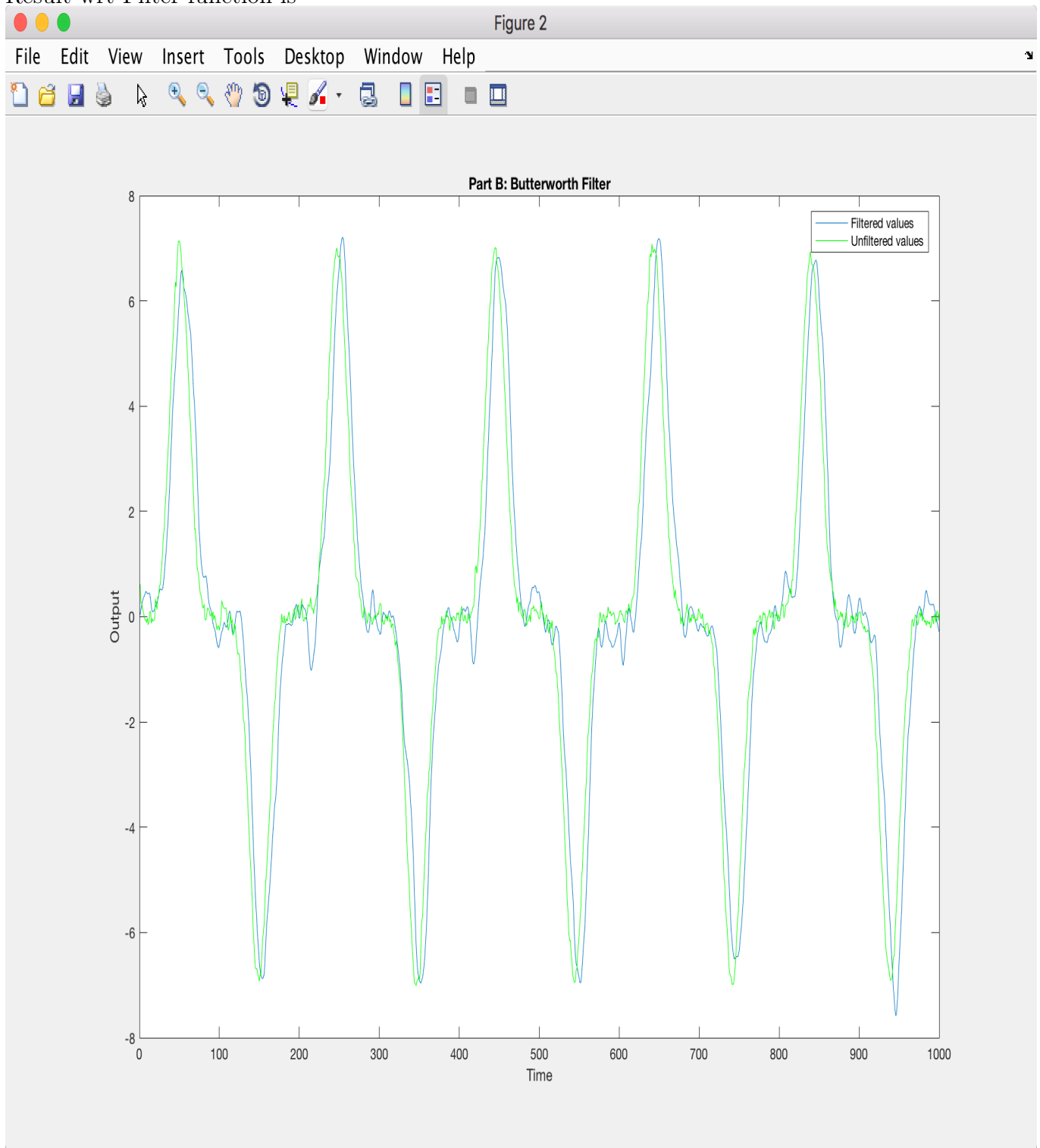
Problem 1. (a)

The coefficients are :-

0.0201	0.0402	0.0201
1.0000	-1.5610	0.6414

Problem 1. (b)

Result wrt Filter function is



Code:

```

7
8 - Wn=5/(100/2);
9
10 - [B,A]=butter(2,Wn);
11 % to Do find coefficients.
12
13 - xF=filter(B,A,yn); %Xf = Transmitted
14 - t = 1:1000;
15
16 - figure;
17 - plot(t,xF,t,xn,'g'); %X1,Y1,LineSpec1,...,Xn,Yn,LineSpecn
18 - xlabel('Time');
19 - ylabel('Output');
20 - title('Part B: Butterworth Filter');
21 - legend('Filtered values','Unfiltered values');
22

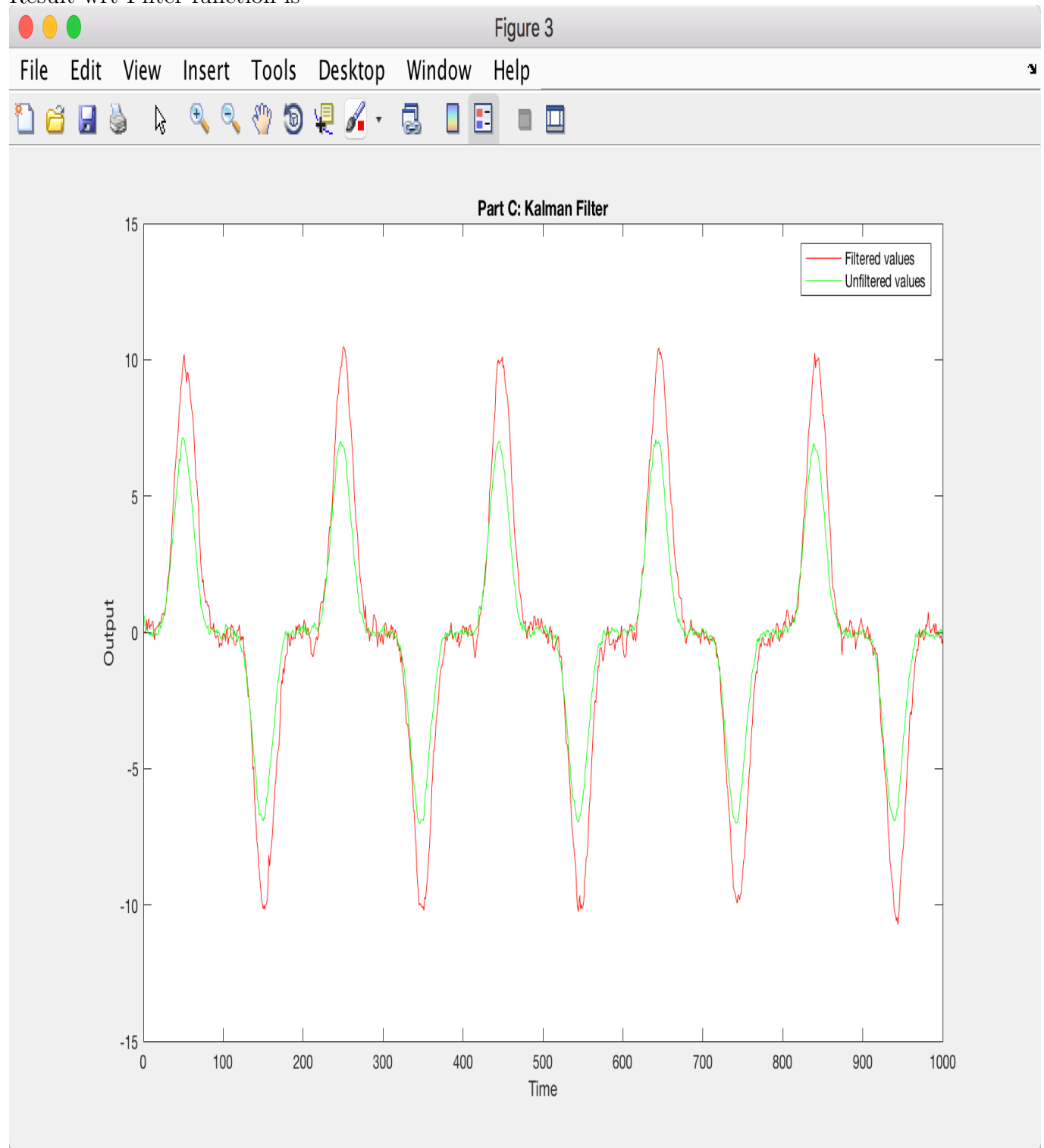
```

Estimated delay

In this case the estimated delay is about 5ms.

Problem 1. (c)

Result wrt Filter function is



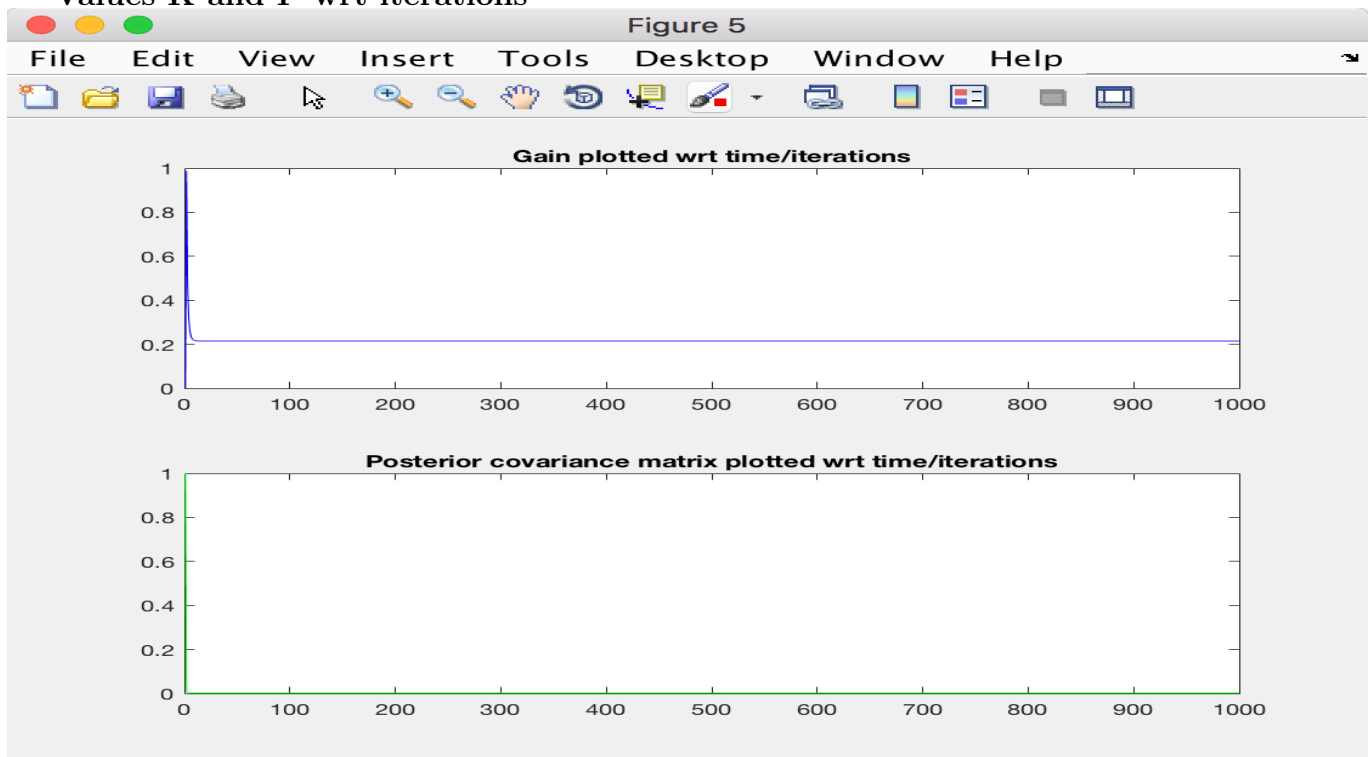
Code:

```

28 %Initializations
29 - Q=0.001;
30 - R=0.01;
31 - A=0.9;
32 - B=2;
33 - P=zeros(1,lengthi);
34 - X=zeros(1,lengthi);
35 - P(1)=1;
36
37 - for i=2:lengthi
38 -     X(i) = A*X(i-1)+B*un(i-1);
39 -     Ptemp = P(i-1);
40 -     newP = (A*Ptemp*A')+Q;
41 -     K=newP./(newP+R);
42 -     X(i)=X(i)+(K*(yn(i)-X(i)));
43 -     P(i) = (1-K).* newP;
44 - end
45
46 - figure;
47 - plot(t,X,'r', t,xn,'g');
48 - xlabel('Time');
49 - ylabel('Output');
50 - title('Part C: Kalman Filter');
51 - legend('Filtered values','Unfiltered values');
52

```

Values K and P wrt iterations



Initilization of P

The P at iteration 0 was initialized as 1 and all subsequent values of P is computed using recursion formula.

Estimated delay

In this case is approx 3ms.

Comparison Kalman vs Butterworth filtering

Kalman performs better as delay is less and it converges faster.