Name Answer

EE-3220 – Dr. Durant – Quiz 3
Winter 2016-'17, Week 3

1. (3 points) Calculate the convolution $y(n) = x_2(n) * h_2(n) = [3\ 6\ -1] * [2\ -5\ 4]$. Show your work (intermediate products; you are not required to show the formula for the convolution sum). Both sequences start at n=0.

	n				
k	0	1	2	3	4
0	6	-15	12		
1		12	-30	24	
2			-2	5	-4
y:	6	-3	-20	29	-4

$$y(n) = \sum_{k=-\infty}^{\infty} x(k)\,h(n-k)$$

2. (3 points) ***Calculate*** the first 4 samples of the unit ***impulse*** response of y(n) = 3 y(n–1) + 2x(n) – 5x(n–1). Recall that the impulse response is y(n) when x(n) = δ(n).

3. (2 points) ***Re-write*** the equation in standard form. ***Indicate*** the name of each coefficient (a_1, etc.).

4. (2 points) ***Write MATLAB code*** using filter(b,a,x) function in MATLAB that calculates the first 10 samples of the unit ***impulse*** response, h. Write the complete code needed to calculate h.

(2)

n	x(n)	y(n)
0	1	$3y(-1)+2x(0)-5x(-1) = 3\cdot 0+2\cdot 1-5\cdot 0 = 0+2-0 = 2$
1	0	$3y(0)+2x(1)-5x(0) = 3\cdot 2+2\cdot 0-5\cdot 1 = 6+0-5 = 1$
2	0	$3y(1)+2x(2)-5x(1) = 3\cdot 1+2\cdot 0-5\cdot 0 = 3+0-0 = 3$
3	0	$3y(2)+2x(3)-5x(2) = 3\cdot 3+2\cdot 0-5\cdot 0 = 9+0-0 = 9$

(3) $y(n) - 3y(n-1) = 2x(n) - 5x(n-1)$

a_0 a_1 b_0 b_1

(4)

```
a = [1 -3];
b = [2 -5];
n = 0:10;
d = n==0; % x(n)=δ(n)
h = Filter(b,a,d); % h(n)=y(n) when x(n)=δ(n)
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% Dr. Durant - EE3220 Quiz 3 - 2016-12-13
figure

%% Problem 1
x2 = [3 6 -1];
h2 = [2 -5 4];
y = conv(x2,h2); % result: [6 -3 -20 29 -4]
n1 = 0:(length(y)-1);
subplot(2,1,1), stem(n1,y), title('Problem 1')

%% Problem 4
a = [1 -3];
b = [2 -5];
n = 0:10;
d = n == 0; % x(n) = delta(n)
h = filter(b,a,d); % h(n) = y(n) when x(n) = delta(n)
% result = [2 1 3 9 27 81 243 729 2187 6561 19683] (unstable!)
subplot(2,1,2), stem(n,h), title('Problem 4')
```
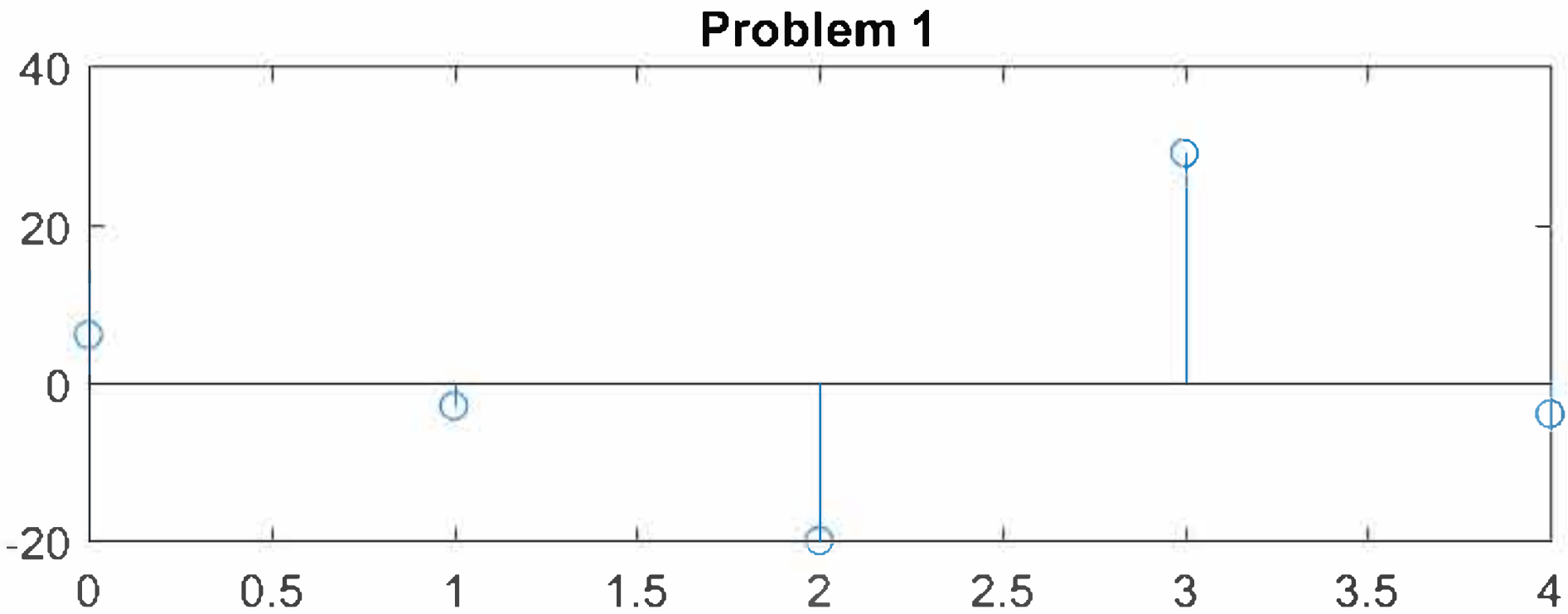
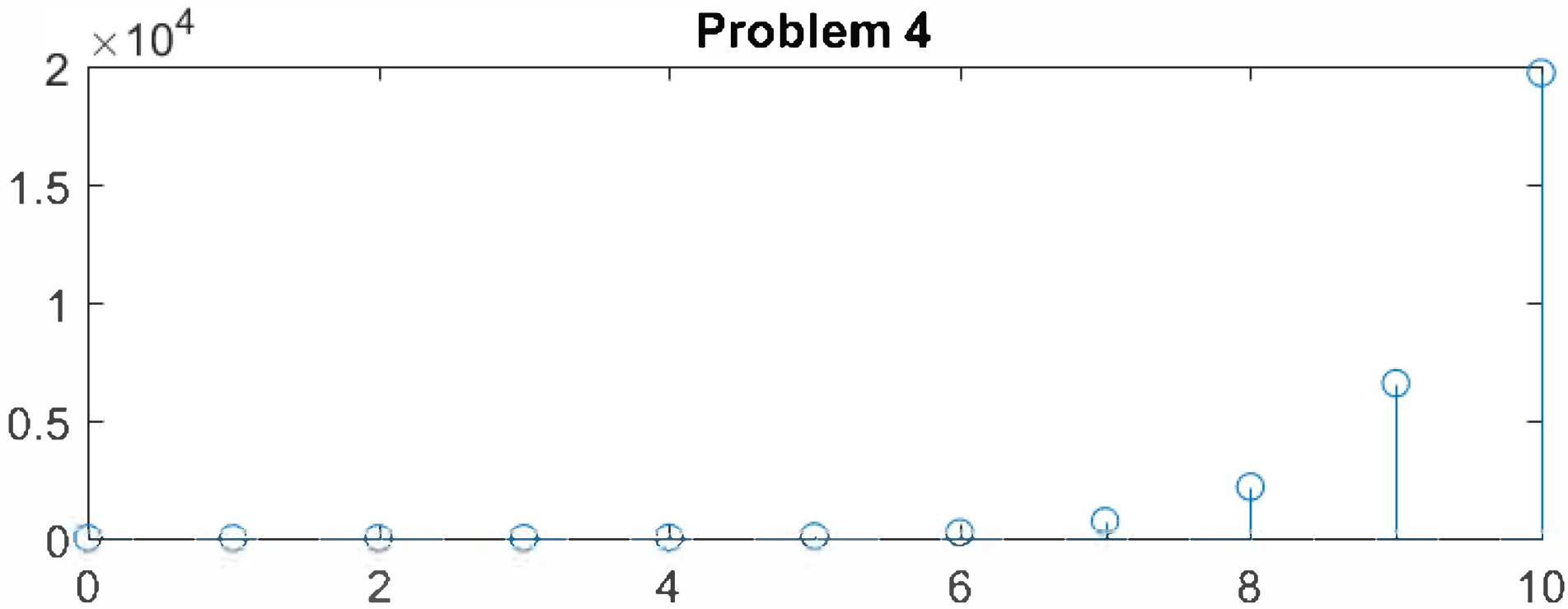


Problem 1
40
20
0
-20
0
0.5
1
1.5
2
2.5
3
3.5
4


Problem 4
×10^4
2
1.5
1
0.5
0
0
2
4
6
8
10