



DSP Lab. Week 6

Convolution

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Convolution

Input signal

impulse response

output signal



$$y[n] = h[n] * x[n] = \sum_{k=-\infty}^{\infty} h[k]x[n-k]$$

Example)

$$y[n] = 2x[n] + 3x[n-1]$$

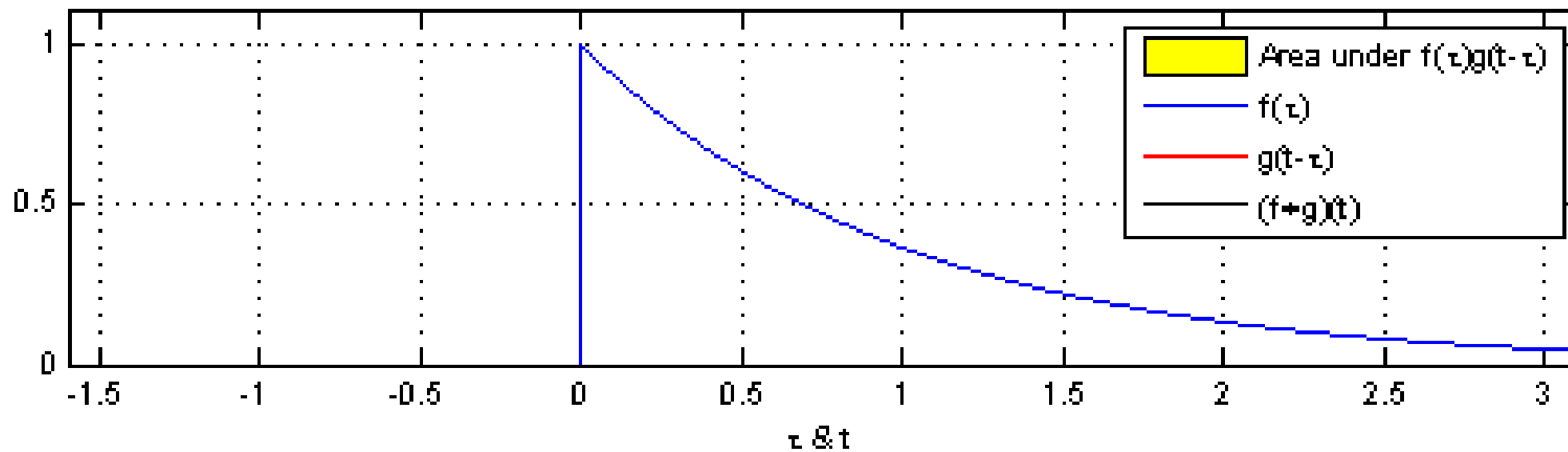
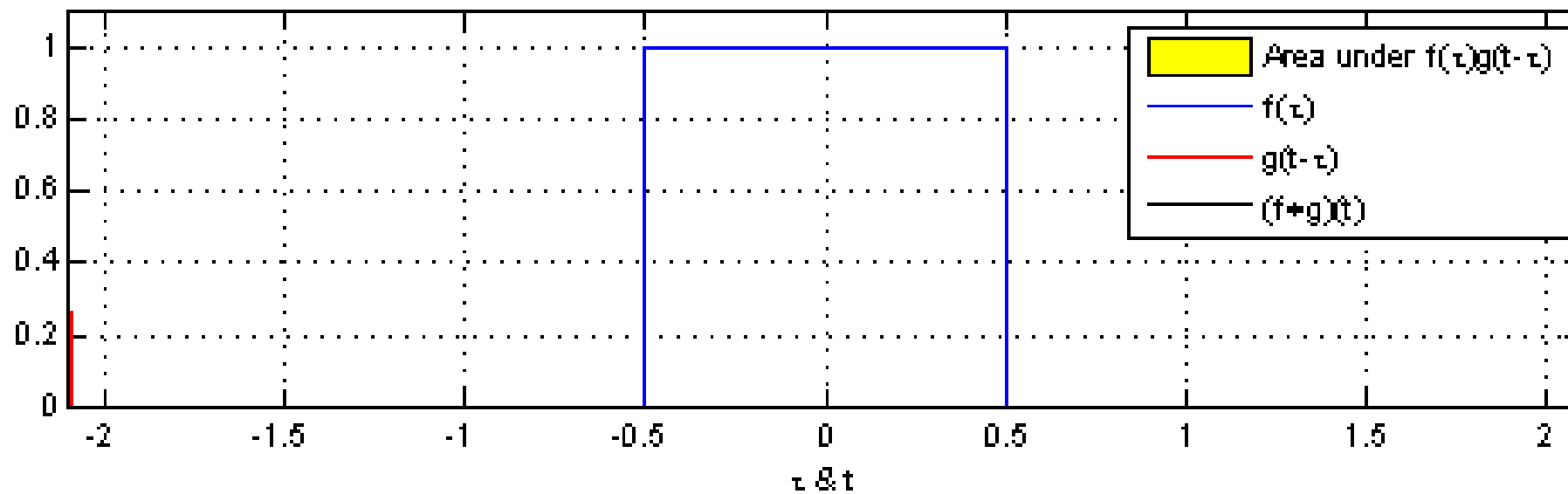
Impulse response는 $x[n] = \delta[n]$ 일 때, $y[n]$ 이니까

$$h[n] = 2\delta[n] + 3\delta[n-1]$$

따라서, $h[0] = 2, h[1] = 3$



Convolution





Convolution

1. 교환

$$x(t) * h(t) = h(t) * x(t)$$

2. 결합

$$\{x(t) * h_1(t)\} * h_2(t) = x(t) * \{h_1(t) * h_2(t)\}$$

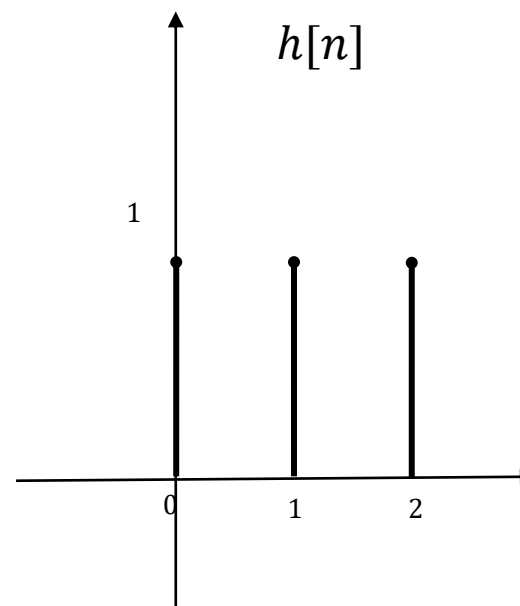
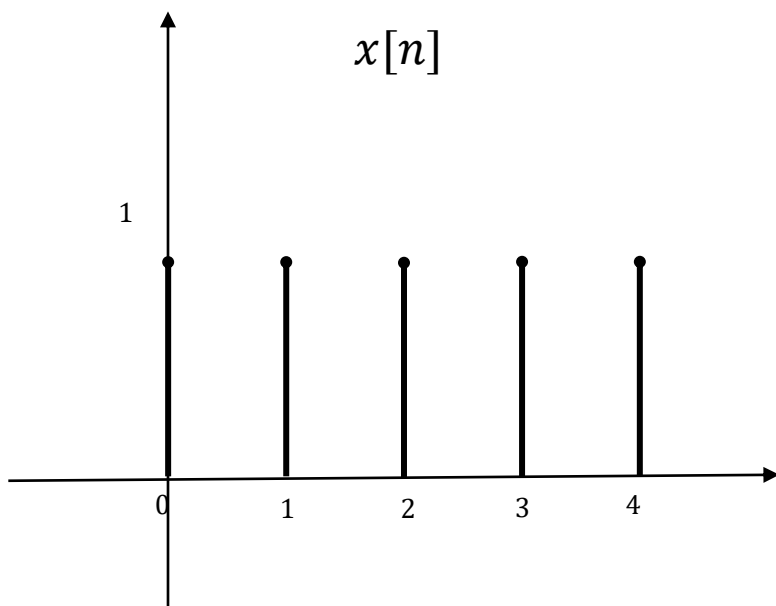
3. 분배

$$x(t) * \{h_1(t) + h_2(t)\} = x(t) * h_1(t) + x(t) * h_2(t)$$



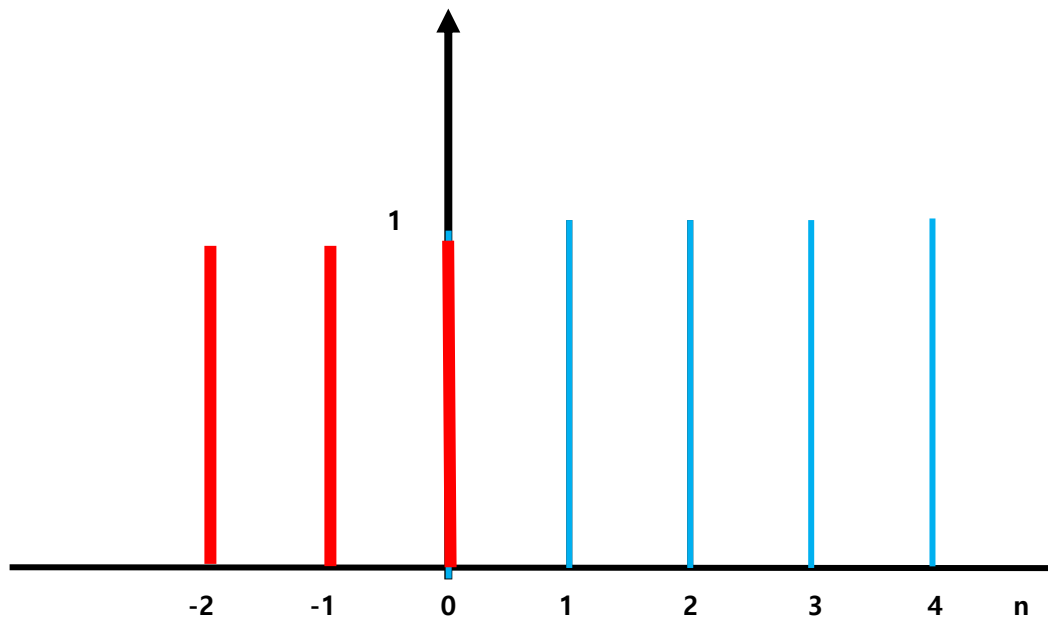
Convolution

$$y[n] = x[n] * h[n] = \sum_{k=-\infty}^{\infty} x[k]h[n-k]$$



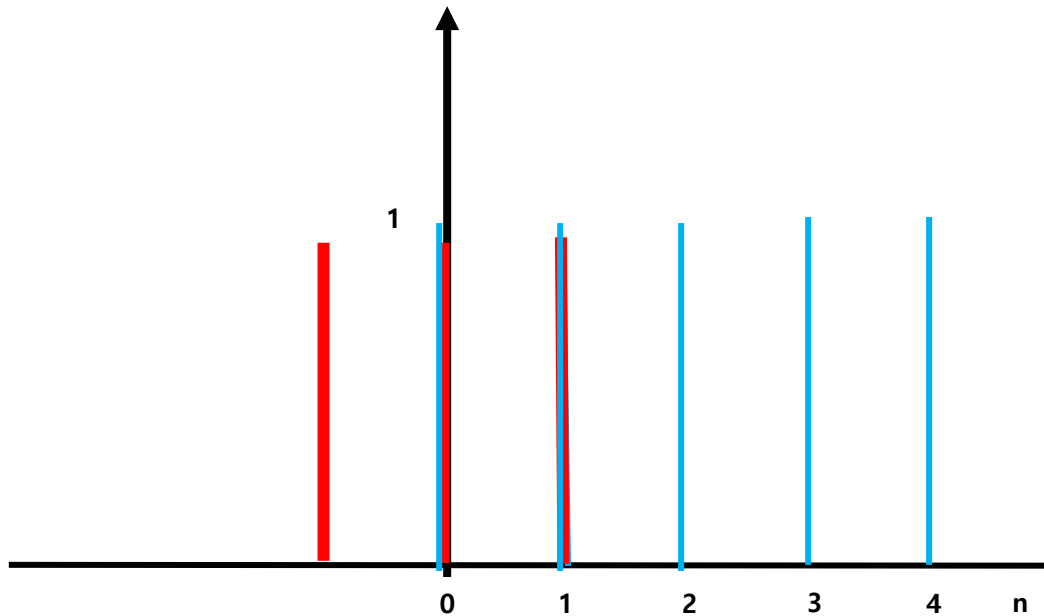


Convolution



$$y[0] = \sum_{k=-\infty}^{\infty} x[k] \times h[0-k]$$

$$= y[0] = x[0] \times h[0] = 1$$

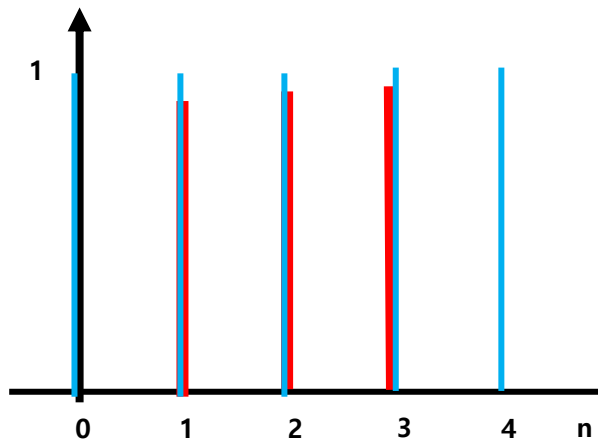
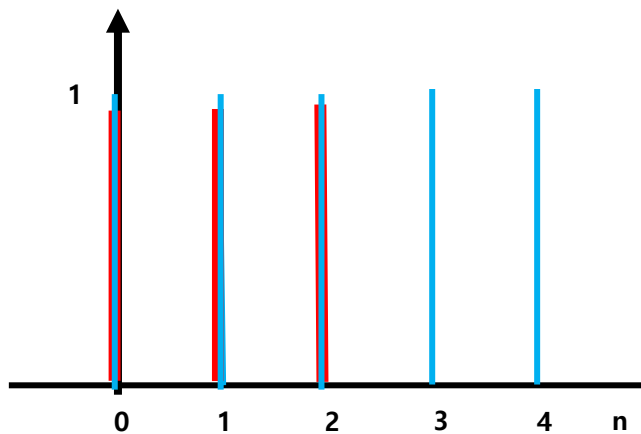


$$y[1] = \sum_{k=-\infty}^{\infty} x[k] \times h[1-k]$$

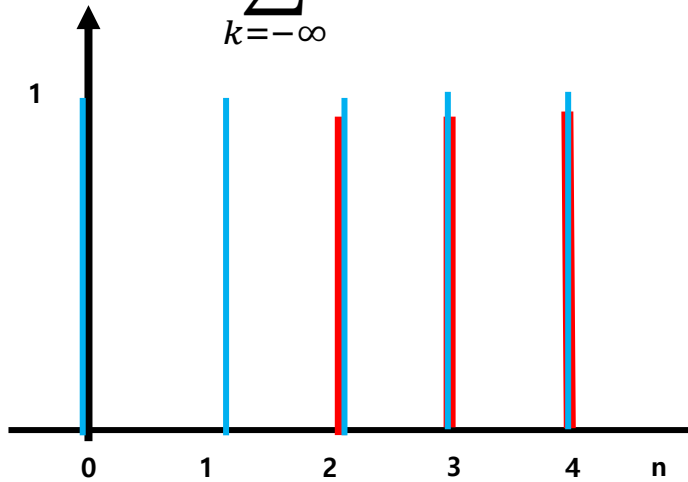
$$= y[1] = x[0] \times h[1] + x[1] \times h[0] = 2$$



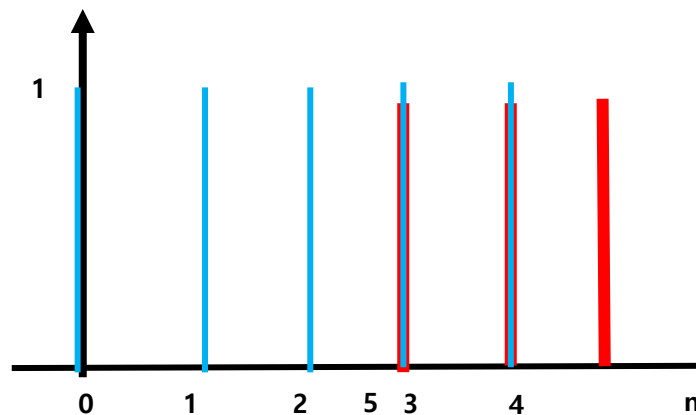
Convolution



$$y[4] = \sum_{k=-\infty}^{\infty} x[k] \times h[4-k]$$



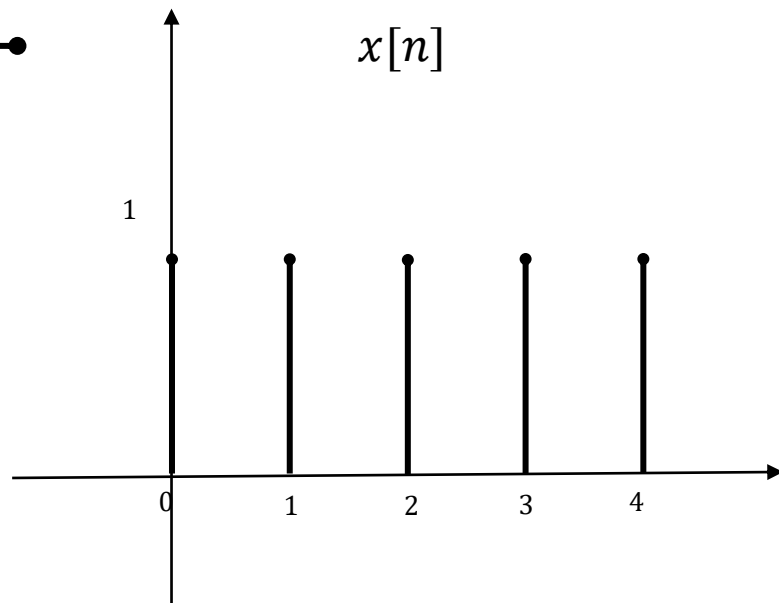
$$y[5] = \sum_{k=-\infty}^{\infty} x[k] \times h[5-k]$$



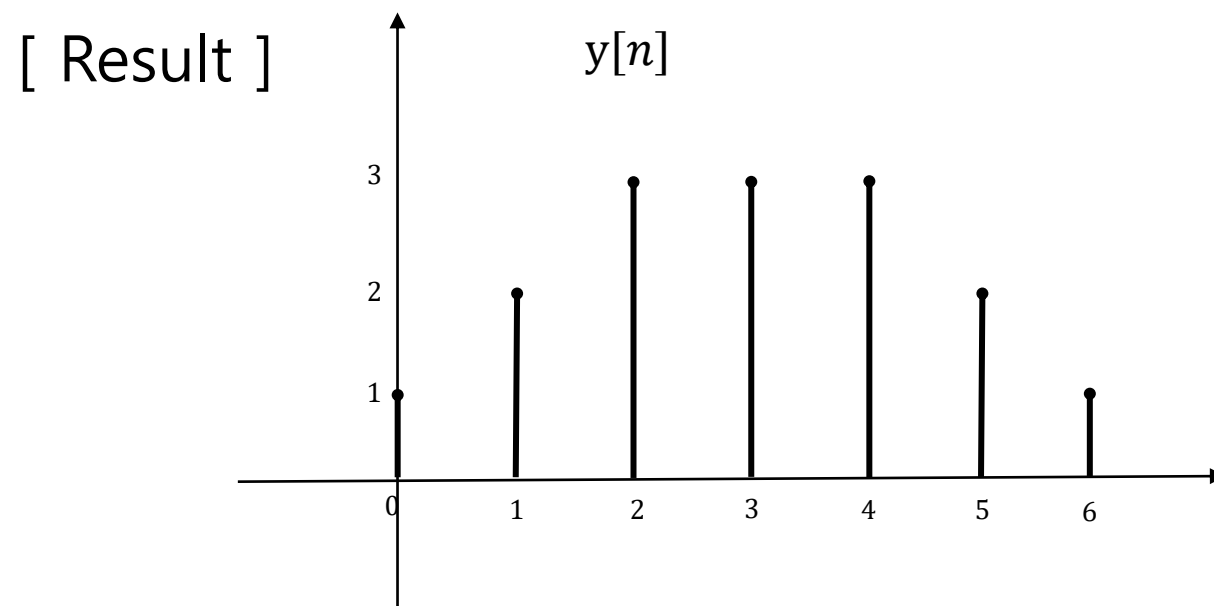
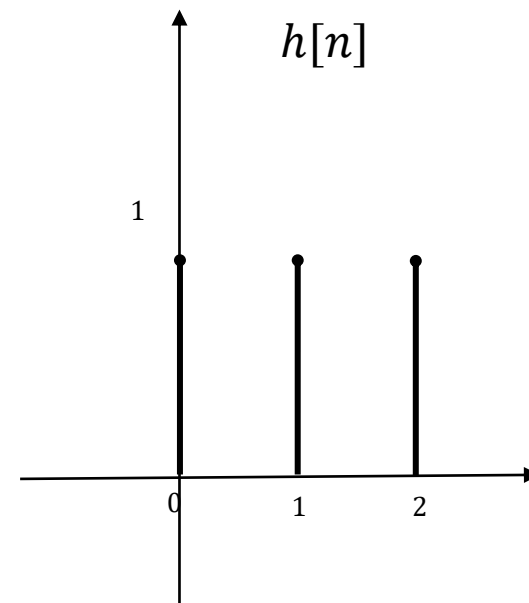
... $y[6], y[7], y[8]$...



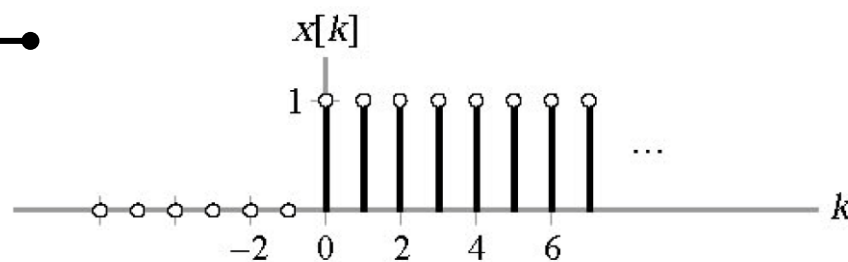
Convolution



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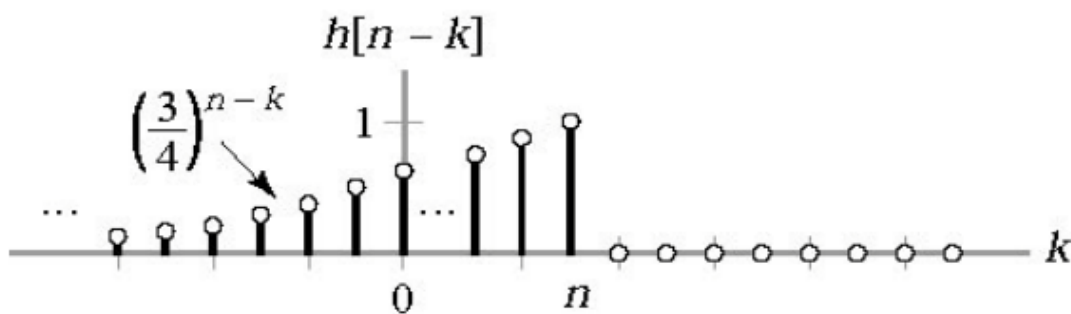


Convolution

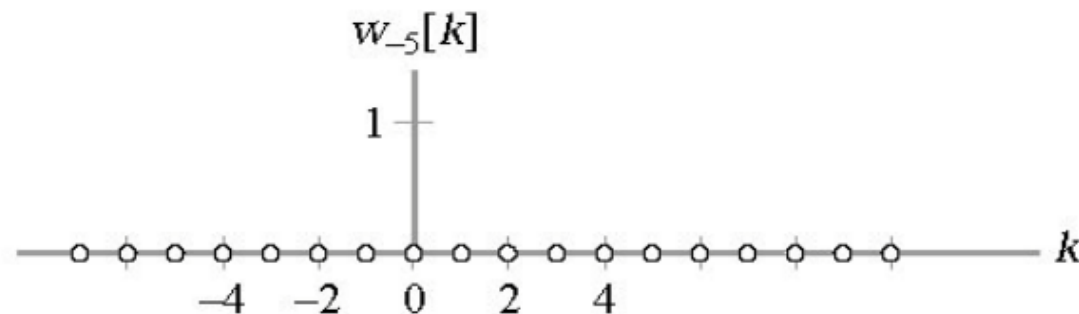


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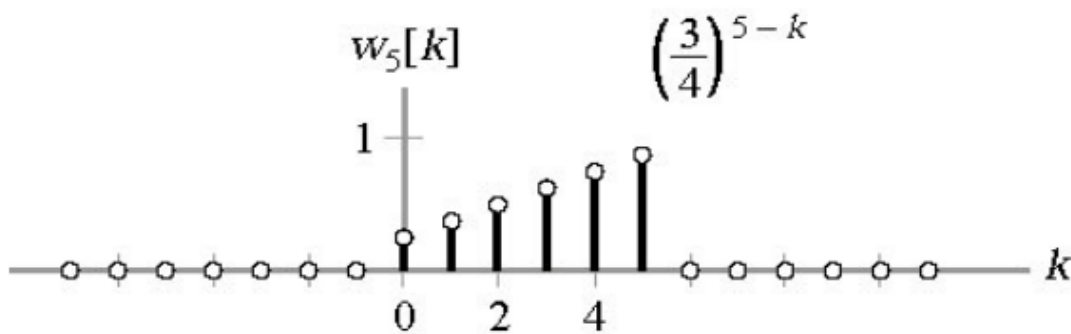
$$h[n] = \left(\frac{3}{4}\right)^n u[n]$$



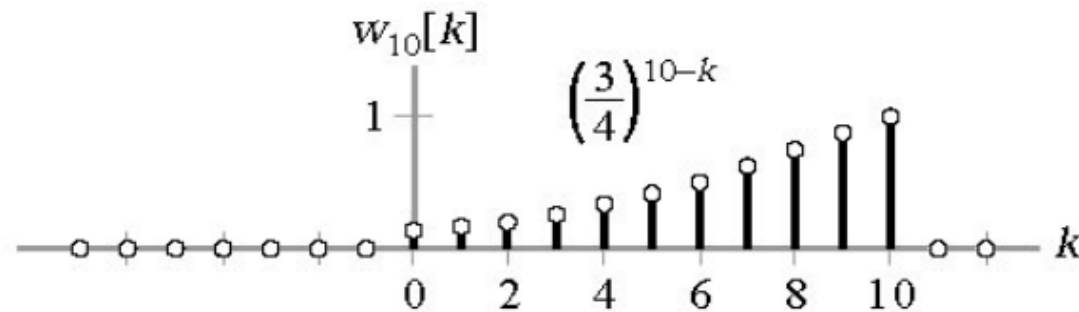
(a)



(b)



(c)



(d)



C++ Programming

$$y[n] = x[n] * h[n] = \sum_{k=-\infty}^{\infty} x[k]h[n-k].$$

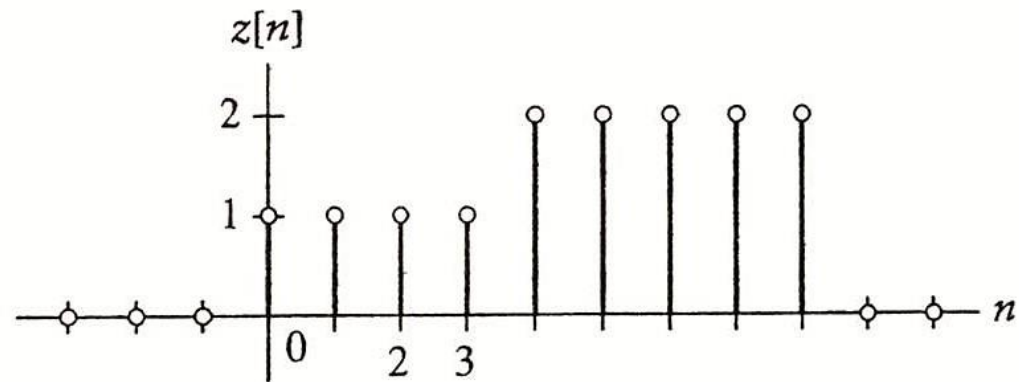
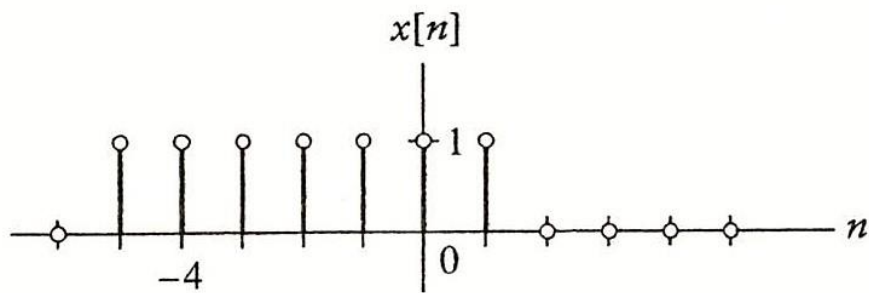
```
int x[5] = { 1,1,1,1,1 };  
int h[3] = { 1,1,1 };  
  
int result = 0;  
  
int n = 2;  
  
for (int k = 0; k <= n; k++)  
{  
    result += x[k] * h[n - k];  
}  
  
cout << "y[" << n << "]" << " = " << result << endl;  
  
return 0;
```

[Result]

y[2] = 3



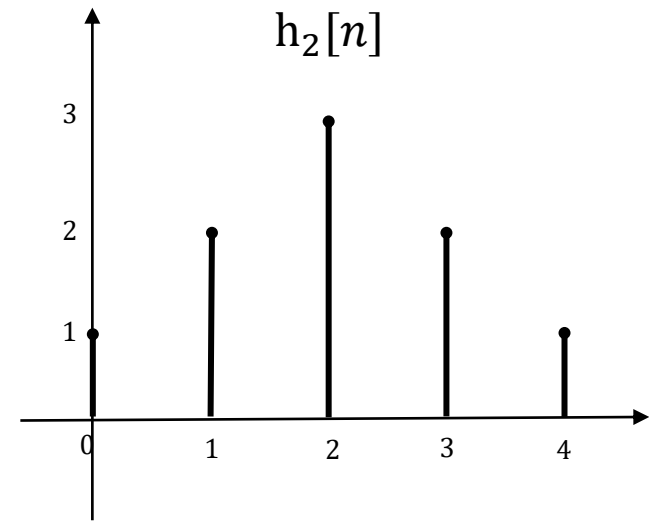
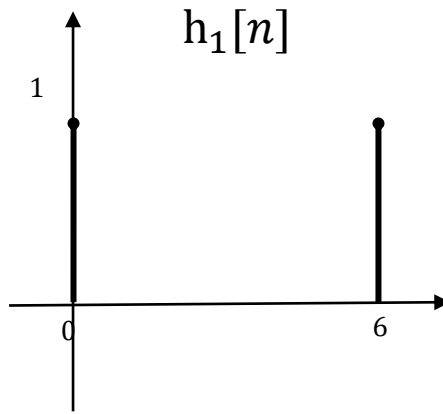
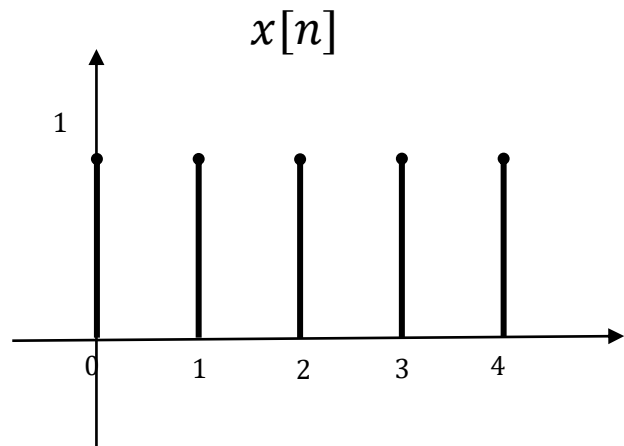
C++ Programming



$$y[n] = x[n] * z[n]$$

Draw $y[n]$ using c++ programming and excel

Week 6 assignment



1. $y[n] = x[n] * h_1[n] * h_2[n]$

2. $y[n] = \cos(2\pi t)(u(t+1)-u(t-1)) * e^{-t}u(t)$

$y[n]$ 을 c++ 프로그래밍을 통해 계산하고, 엑셀을 이용하여 그래프를 그려라



Week 6 assignment

“KLAS에 제출할 때 다음 사항을 꼭 지켜주세요”

1. 파일명 : “Lab00_요일_대표자이름.zip”

Ex) Lab01_목_홍길동.zip (압축 톨은 자유롭게 사용)

2. 제출 파일 (보고서와 프로그램을 압축해서 제출)

- 보고서 파일 (hwp, word): 이름, 학번, 목적, 변수, 알고리즘(순서), 결과 분석, 느낀 점
- 프로그램

DSP 실험 보고서

과제 번호	Lab01	제출일	2019.09.02
학번/이름	20xxxxxxx 홍길동 20xxxxxxx 푸리에		

1. 목적	
2. 변수	
3. 알고리즘	
4. 결과분석	
5. 느낀 점	

