DSP Lab. Week 6
Convolution

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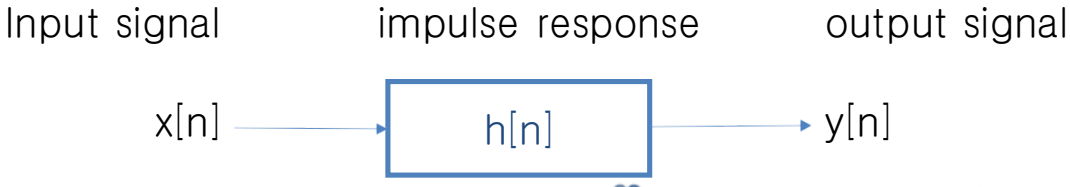
Convolution



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

Example)

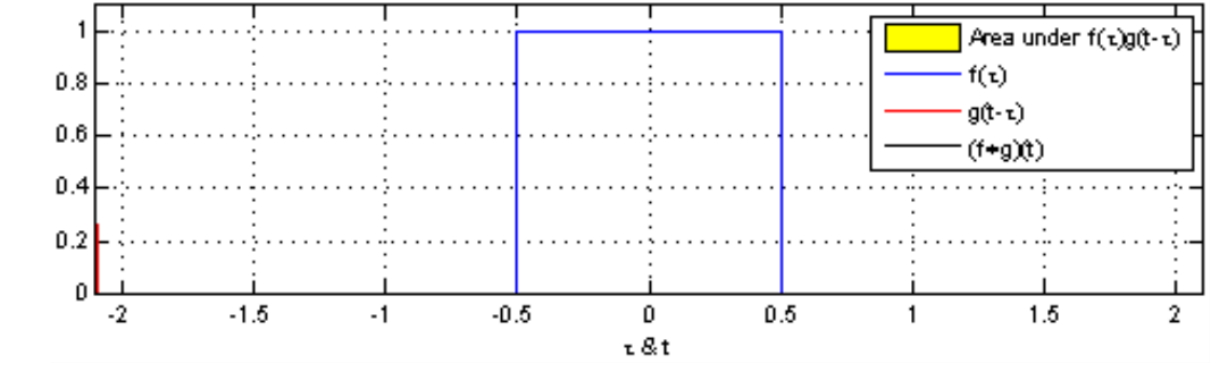
$$y[n] = 2x[n] + 3x[n-1]$$

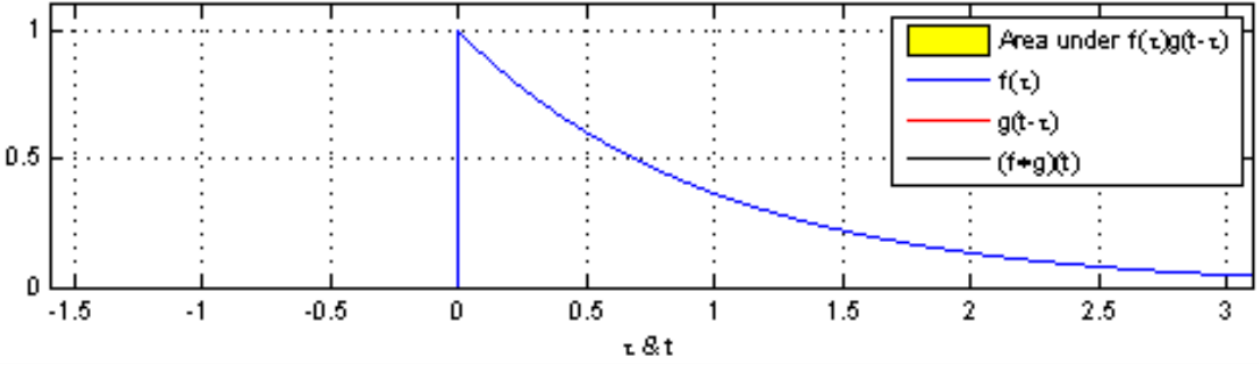
Impulse response는 $x[n] = \delta[n]$일 때, y[n]이니까

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

따라서, $h[0] = 2, h[1] = 3$

Convolution





Convolution

1. 교환

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

2. 결합

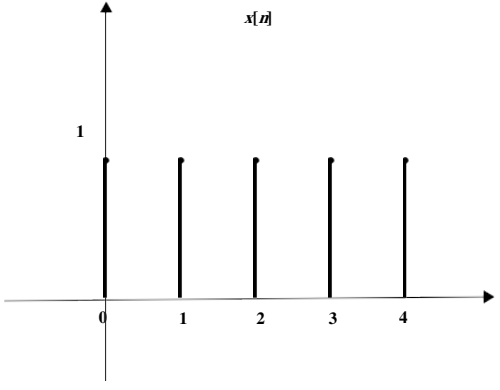
$$\{x(t)*h_1(t)\}*h_2(t) = x(t)*\{h_1(t)*h_2(t)\}$$

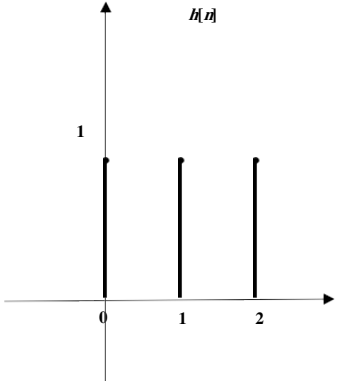
3. 분배

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

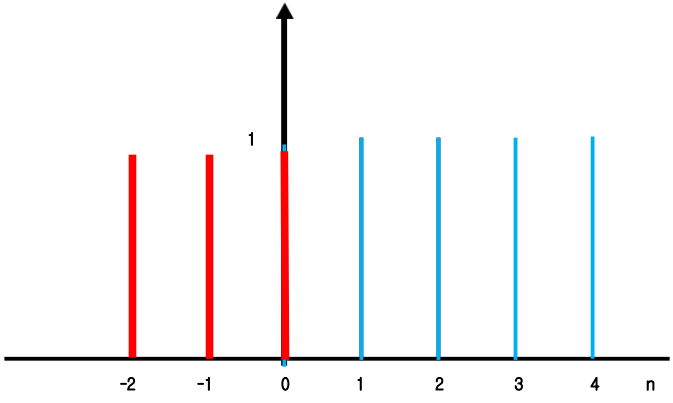
Convolution

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



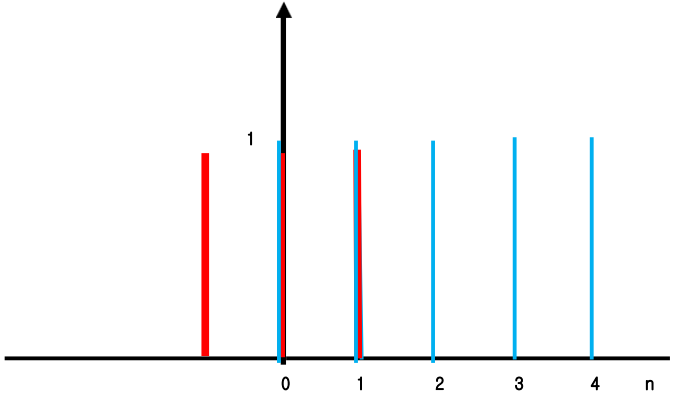


Convolution



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

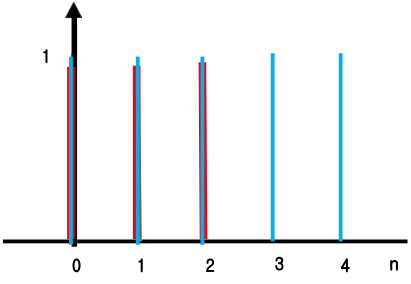
$$= y[0]= x[0]\times h[0] = 1$$



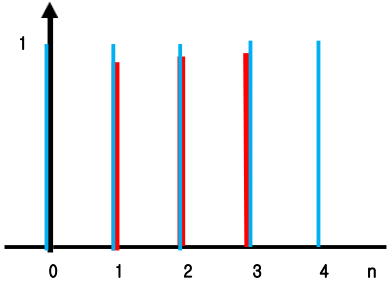
$$y[1]=\sum_{k=-\infty}^{\infty} x[k]\times h[1-k]$$

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

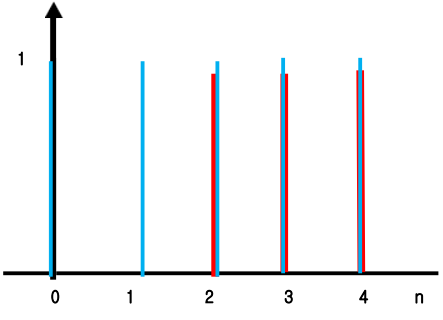
Convolution

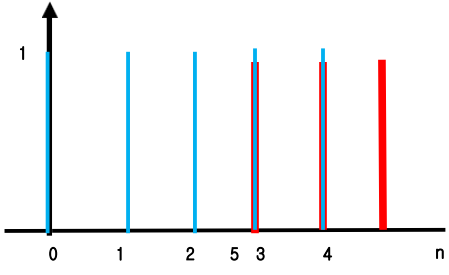


$$y[4]=\sum_{k=-\infty}^{\infty} x[k]\times h[4-k]$$



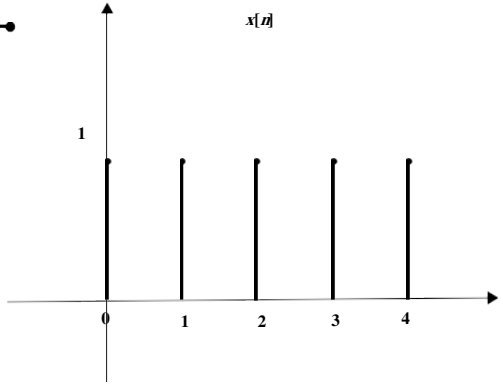
$$y[5]=\sum_{k=-\infty}^{\infty} x[k]\times h[5-k]$$





••• $y[6]$, $y[7]$, $y[8]$ •••

Convolution



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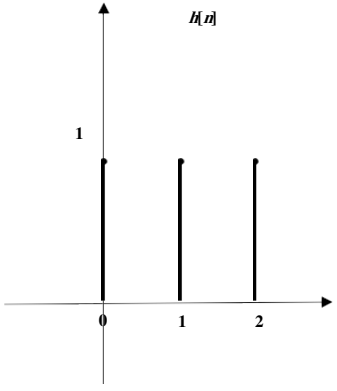
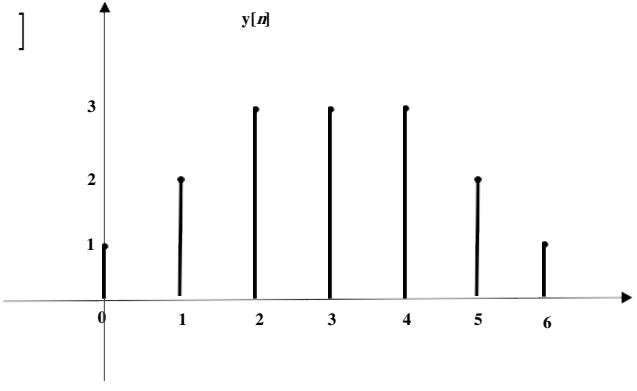
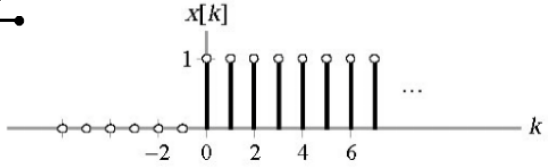


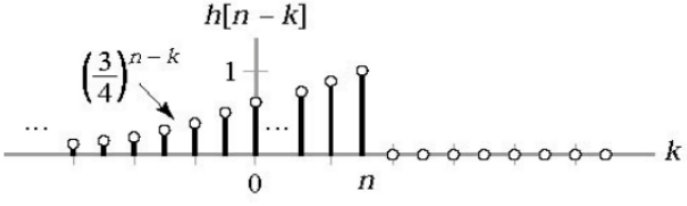
[Result]



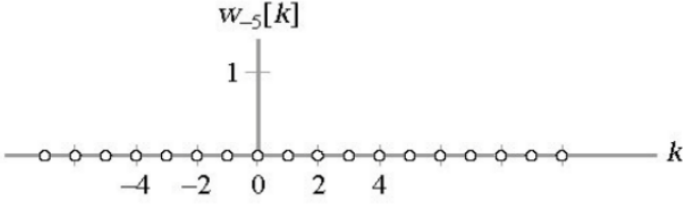
Convolution



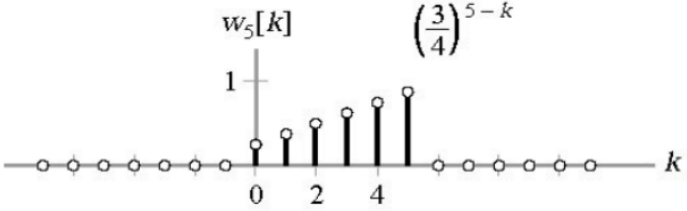
$$*\qquad h[n]=\left(\frac{3}{4}\right)^{n}u[n]$$



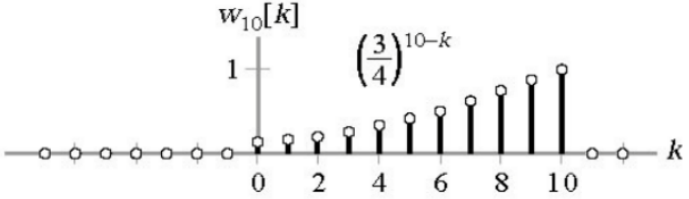
(a)



(b)



(c)



(d)

C++ Programming

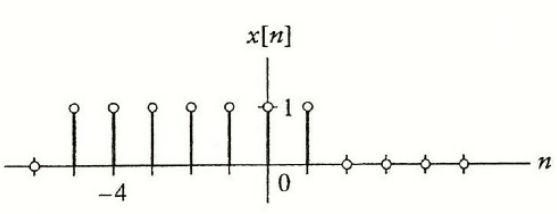
$$y[n] = x[n] * h[n] = \sum_{k=-\infty}^{\infty} x[k]h[n-k].$$

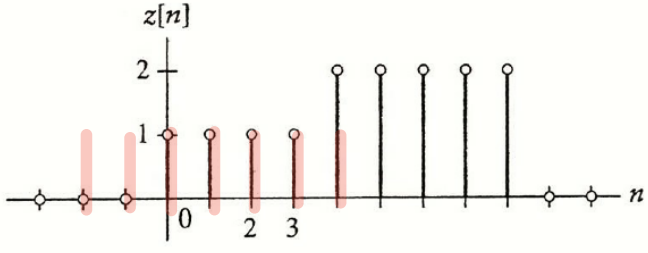
```
int x[5] = { 1,1,1,1,1 };
int h[3] = { 1,1,1 };

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



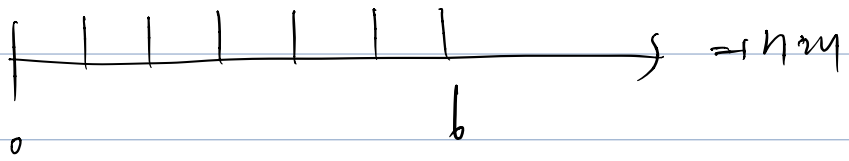


$n \geq 0$

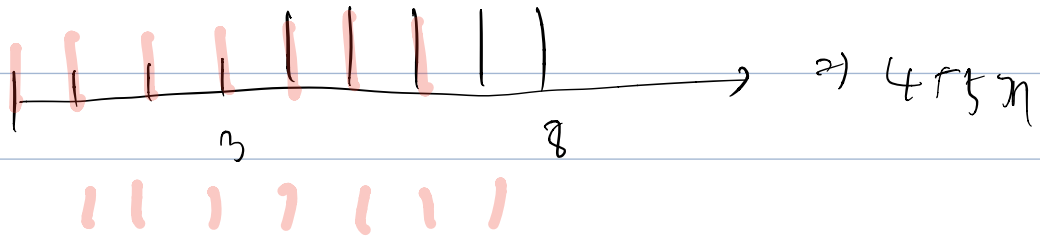
$$y[n] = x[n] * z[n]$$

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

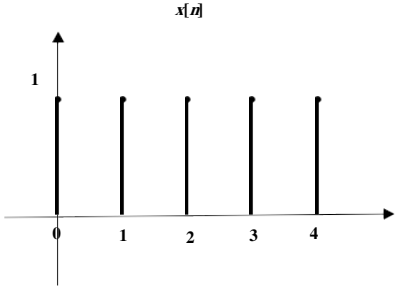
x

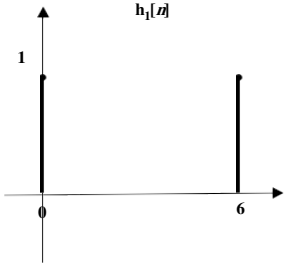


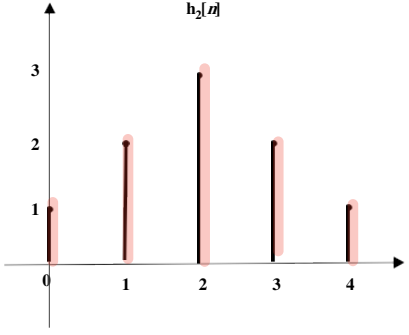
z



Week 6 assignment







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

2. $y[n] = \cos(t)(u(t)-u(t-10)) * e^{-t}(u(t)-u(t-10))$

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 툴은 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	20xxxxxxxx 홍길동 20xxxxxxxx 푸리에		

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