1.x =[2,2,2], h=[2,2,2] 做卷積，另依下側條件各做一次卷積。

- **試改變 x，再觀察 y。**
- **試改變 h，再觀察 y。**

問題

- 問輸出為何? (3 組答案) **(8 分)**
- 請將輸出畫圖。 (3 張圖) **(4 分)**
- 將數學推導詳細列出。(由題目那組推導) **(4 分)**
- 輸出的長度與 x, h 之間的長度有何關係? **(9 分)**

```
x=[2,2,2]
```

```
x = 1×3
     2     2     2
```

```
h=[2,2,2,3]
```

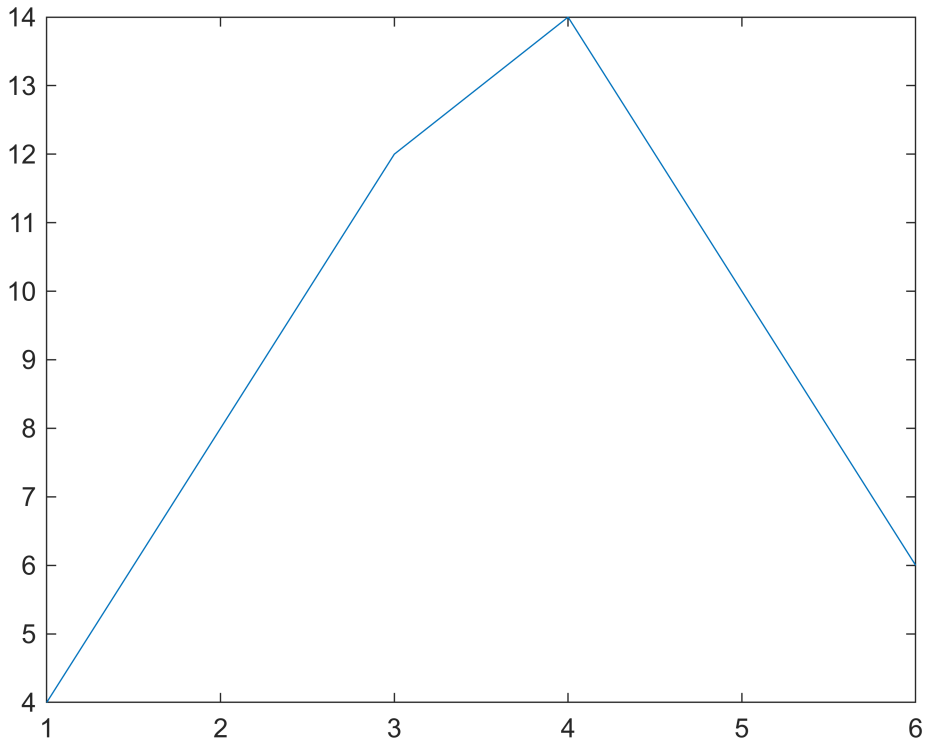
```
h = 1×4
     2     2     2     3
```

```
c=conv(x,h)
```

```
c = 1×6
     4     8    12    14    10     6
```

```


plot(c)
```




```
x=[2,2,2]
```

```
x = 1×3
     2     2     2
```

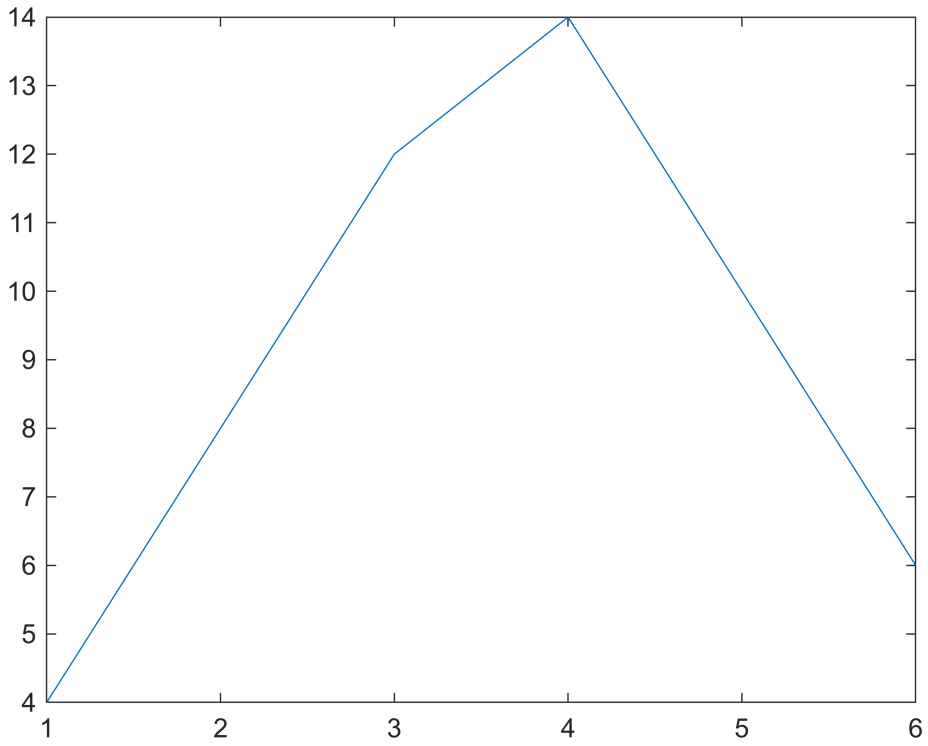
```
h=[2,2,2,3]
```

```
h = 1×4
     2     2     2     3
```

```
c=conv(x,h)
```

```
c = 1×6
     4     8    12    14    10     6
```

```
plot(c)
```




```
x=[2,2,4]
```

```
x = 1×3
     2     2     4
```

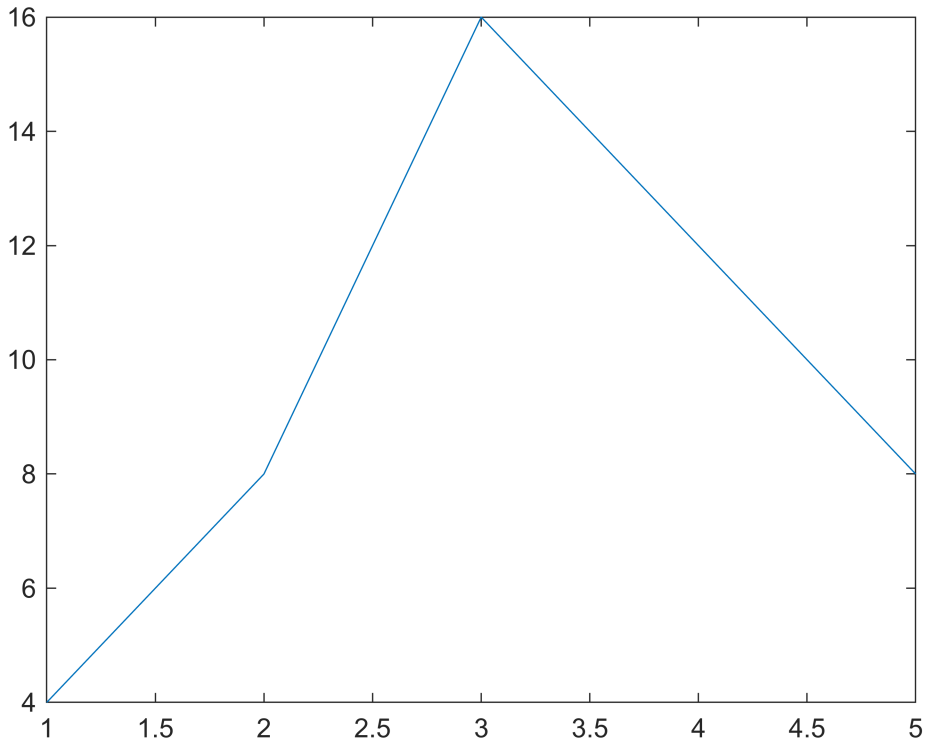
```
h=[2,2,2]
```

```
h = 1×3
     2     2     2
```

```
c=conv(x,h)
```

```
c = 1×5
     4     8    16    12     8
```

```
plot(c)
```




```
%X 與 h 是因為  h 反轉再重合相乘
%兩個 vector 的長度相加減一
```

2.請問下列卷積後輸出為何?

- x= cos(2*pi*f*time) [Lab 3 FFT 範例], h=[1,1,1] **(15 分)**
- x=[2 1; 3 2], h=[-1 1; 2 1] **(10 分)**

```
N=256
```

```
N = 256
```

```
fs=8000
```

```
fs = 8000
```

```
freqStep=fs/N
```

```
freqStep = 31.2500
```

```
time=(0:N-1)/fs
```

```
time = 1×256
         0    0.0001    0.0003    0.0004    0.0005    0.0006    0.0008    0.0009 ···
```

```
f=10*freqStep
```

```
f = 312.5000
```

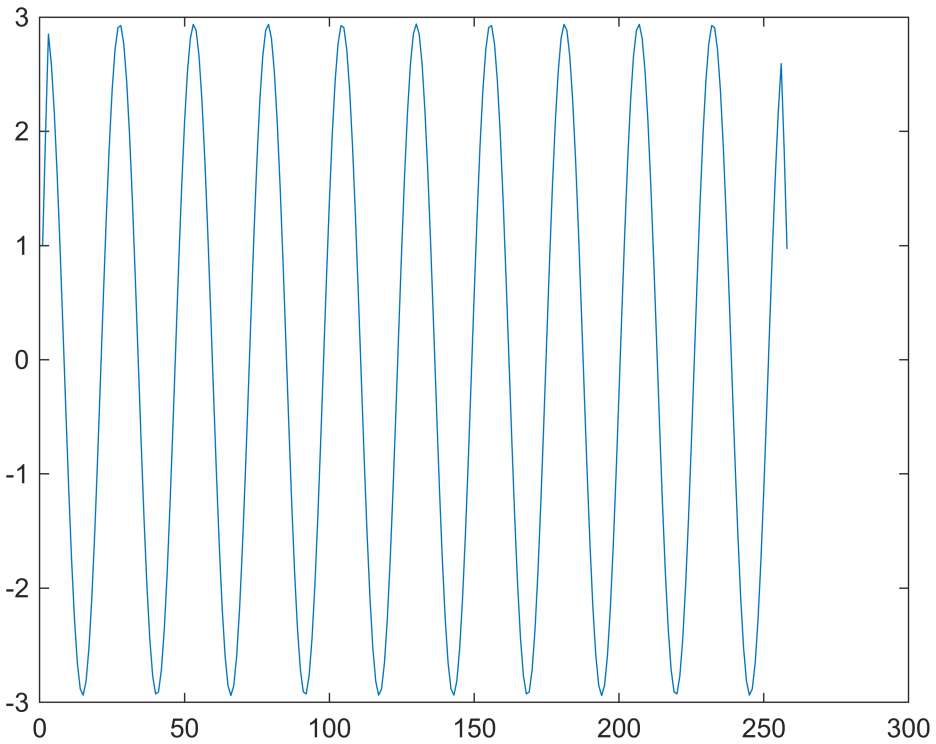
```
x= cos(2*pi*f*time)
```

```
x = 1×256
    1.0000    0.9700    0.8819    0.7410    0.5556    0.3369    0.0980   -0.1467 ···
```

```
h=[1,1,1]
```

```
h = 1×3
     1     1     1
```

```
imp = [1; zeros(49,1)];
plot(conv(x,h))
```




```
x=[2 1; 3 2 ]
```

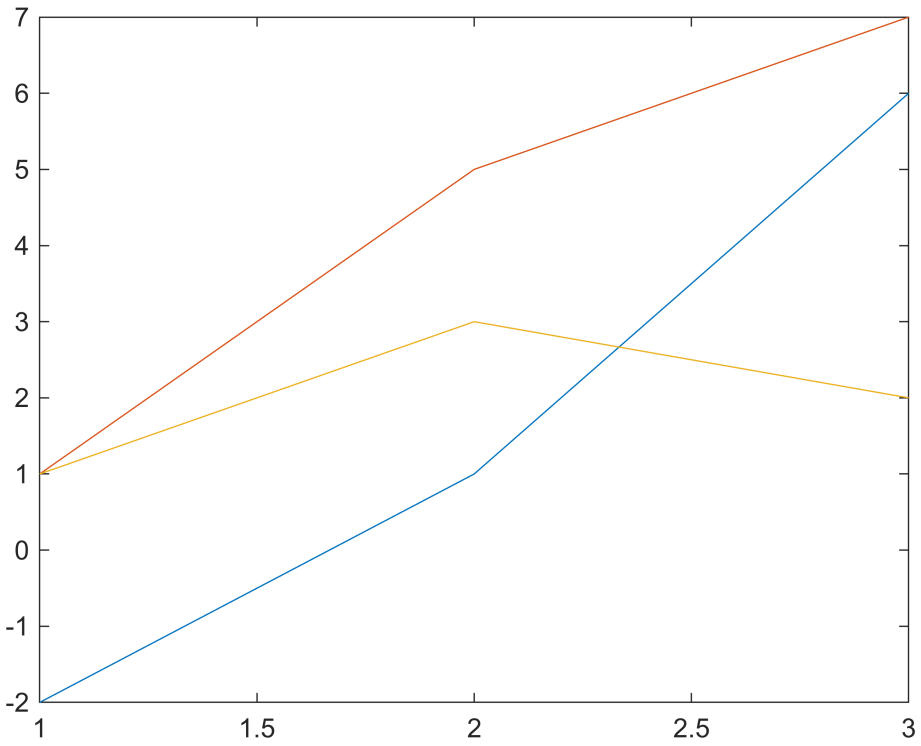
```
x = 2×2
     2     1
     3     2
```

```
h=[-1 1; 2 1]
```

```
h = 2×2
    -1     1
     2     1
```

```
plot(conv2(x,h))
```

```
axis tight
```



3.兩個系統皆具有脈衝響應(impulse responses)，並使用 MATLAB 指令繪製階躍響應(step responses)後的結果。**(25%)**

```
t=-5:1:5
```

```
t = 1×11
    -5    -4    -3    -2    -1     0     1     2     3     4     5
```

```
h1=[0.25 0.25 0.25 0.25 zeros(1,6)]
```

```
h1 = 1×10
    0.2500    0.2500    0.2500    0.2500         0         0         0         0 ···
```

```
h2=[0.25 -0.25 -0.25 0.25 zeros(1,6)]
```

```
h2 = 1×10
    0.2500   -0.2500   -0.2500    0.2500         0         0         0         0 ···
```

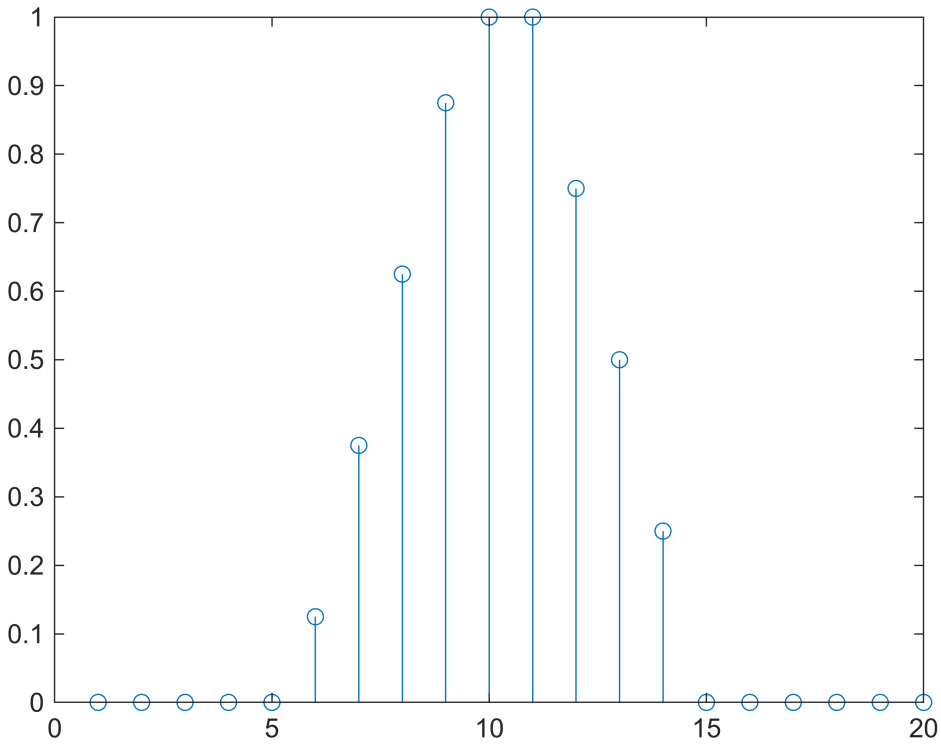
```
x=conv(h1,heaviside(t))
```

```
x = 1×20
         0         0         0         0         0    0.1250    0.3750    0.6250 ···
```

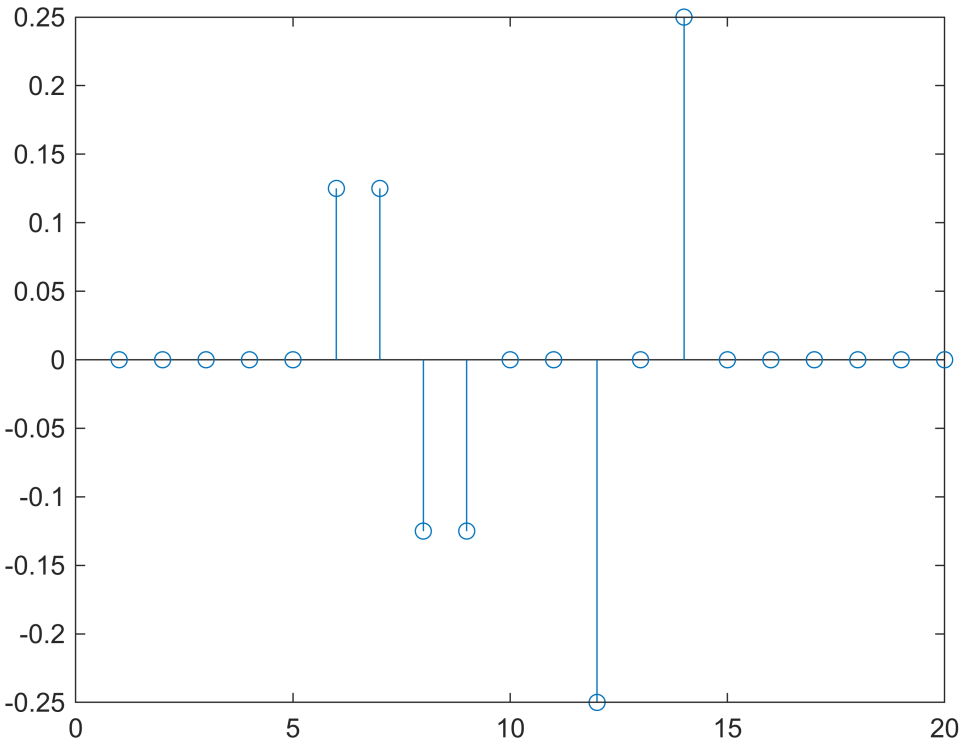
```
x1=conv(h2,heaviside(t))
```

```
x1 = 1×20
         0         0         0         0         0    0.1250    0.1250   -0.1250 ···
```

```
stem(x)
```




```
stem(x1)
```



4.使用 MATLAB 指令，繪製以下捲積圖，

y(t) = (e-at・u (t)) ∗ (cos2πft・u(t))，其中從 t=0 到 3、a=2、f=20

繪製 y(t) 整段訊號。　　(25 分)

- **給定 t and u(t)，Δt = 0.1。**
- **使用函式: x1 = e-at・u (t)**
- **使用函式: x2 = cos2πft・u(t)**
- **使用函式: y = x1 * x2**

```
t= 0:0.1:3
```

```
t = 1×31
         0    0.1000    0.2000    0.3000    0.4000    0.5000    0.6000    0.7000 ···
```

```
a=2
```

```
a = 2
```

```
f=20
```

```
f = 20
```

```
%x1=(exp())
x1 = exp(-a*t).*heaviside(t)
```

```
x1 = 1×31
    0.5000    0.8187    0.6703    0.5488    0.4493    0.3679    0.3012    0.2466 ···
```

```
x2 = cos(2*pi*f*t).*heaviside(t)
```

```
x2 = 1×31
    0.5000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000 ···
```

```
y=conv(x1,x2)
```

```
y = 1×61
    0.2500    0.9094    1.6539    2.2635    2.7625    3.1711    3.5057    3.7796 ···
```

```
stem(y)
```