3.22 (a) $V = [1 \ 2 \ 1]^T$, $w^T = [2 \ 1 \ 1 \ 3]$

$$vw^T = \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix} \underset{Rank=1}{[2 \ 1 \ 1 \ 3]}$$

Rank=1

$$\Rightarrow W = \begin{bmatrix} 2 & 1 & 1 & 3 \\ 4 & 2 & 2 & 6 \\ 2 & 1 & 1 & 3 \end{bmatrix}$$

(b) $W = W_1 \star W_2$

$$= \begin{bmatrix} 1 & 2 & 1 \\ 2 & 6 & 2 \end{bmatrix}$$

$$= \begin{bmatrix} 1 \\ 2 \end{bmatrix} \underbrace{[1 \ 2 \ 1]}$$

$\quad\quad W_1 \quad\quad W_2$

$$\Rightarrow \begin{cases} W_1 = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \\ W_2 = [1 \ 2 \ 1] \end{cases} \#$$

3.28. (a) Yes, 經 3 個 Gausian lowpass filter 後的結果仍為 Gausian

(b) $\sigma = \sqrt{1.5^2 + 2^2 + 4^2} = 4.717 \#$

(c) $m = 3 + 5 + 7 = 15 \#$

3.44. (a) Fig 3.45 (a) $= \begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ (b) $= \begin{bmatrix} 1 & 1 & 1 \\ 1 & -8 & 1 \\ 1 & 1 & 1 \end{bmatrix}$

(No)

(b) Fig 3.50 (b) $\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$ (c) $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$

(No)

(c) Fig 3.50 (d) $\begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{bmatrix}$ (e) $\begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix}$

(Yes) 可分成 $\begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix}[1 \ 2 \ 1]$

4.3 (a) $\delta(t) \ast \delta(t-t_0)$

$= F^{-1}(F(\delta(t) \ast \delta(t-t_0)))$

$= F^{-1}(1 \times e^{-j2\pi w}) = \delta(t-t_0) \#$

b) $\delta(t-t_0) * \delta(t+t_0)$

$= F^{-1}(e^{-j2\pi\omega}) \cdot (e^{j2\pi\omega})$

$= F^{-1}(1) = \delta(t) \quad \#$

4.5| , Fig 3.45 (a) $= \begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix}$

$g(x,y) = G^{-1}[G(u,v)]$

$= G^{-1}\left[e^{j2\pi\mu} + e^{-j2\pi\mu} + e^{j2\pi v} + e^{-j2\pi v} -4\right]$

$= 2\left[\cos(2\pi\mu) + \cos(2\pi v) - 2\right] \quad \#$